DACW-33-87-D-0007 Delivery Order 0005
North Springfield Dam Test Drain Instal.

OFFICE COPY DO NOT REMOVE

ATLANTIC TESTING LABORATORIES, LIMITED

atl

Box 29
Canton, N.Y. 13617
(315) 386-4578

Box 356
Cicero, N.Y. 13039
(315) 699-5281

August 4, 1988

U. S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254-9194

Attn: Mr. Tim Beauchemin

Re: North Springfield Dam Test Drain Installation
(Horizontal Holes)
North Springfield, Vermont
Contract No. DACW33-87-D-0007
Delivery Order No. 0005
ATL Report No. CD032-2-8-88

Gentlemen:

In accordance with your Delivery Order No. 0005 dated 88, May 11, attached is one final copy of our Engineering report for the Test Drain Installation performed at North Springfield, Vermont.

By copy of this letter, we are also transmitting two copies of the report to the Chief of the Geotechnical Engineering Branch.

Please feel free to contact me should you have any questions or comments.

Respectfully submitted,

Gregory Hargrave

Gregory Hargrave
Geologist

GH/smf

encs.

cc: Chief, Geotechnical Engineering Branch

SECTION 1
NORTH SPRINGFIELD DAM TEST DRAIN INSTALLATION
North Springfield, Vermont

Contract No. DACW 33-87-0007
Delivery Order No. 0005

Contracting Officer:

Stanley J. Murphy, Lt. Colonel, CE
Deputy Division Engineer

PREPARED FOR: U.S. Army Corps of Engineers
New Endland Division
424 Trapelo Road
Waltham, MA 02254-9149

PREPARED BY: Atlantic Testing Laboratories, Limited
P.O. Box 29
Canton, NY 13617

ATL Report NO. CD032-1-7-88

8 July 88

SECTION 2

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SECTION 2

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SECTION 3

a. Delivery Order No. 0005

CHECKED BOX APPLIES	☒ ORDER FOR SUPPLIES OR SERVICES	☐ REQUEST FOR QUOTATIONS NO. RETURN COPY(IES) OF THIS QUOTE BY (THIS IS NOT AN ORDER. See DD Form 1155r)	PAGE 1 OF 2

1. CONTRACT/PURCH ORDER NO.	2. DELIVERY ORDER NO.	3. DATE OF ORDER	4. REQUISITION/PURCH REQUEST NO.	5. CERTIFIED FOR NATIONAL DEFENSE UNDER DMS REG DO
ACW33-87-D-0007	0005	88 MAY 11	GEB 88-18	

6. ISSUED BY: Dept. of the Army CODE
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149
Buyer/Symbol: Apidianakis/CENED-CT-C Phone: 617-647-8207

7. ADMINISTERED BY (If other than 6) CODE
PROJECT: Geotechnical Exploratory Work, Various Locations in New England

8. DELIVERY FOB
☒ DEST
☐ OTHER
(See Schedule if other)

9. CONTRACTOR/QUOTER CODE FACILITY CODE

NAME AND ADDRESS
Atlantic Testing Laboratories, Limited
P.O. Box 29
Canton, NY 13617

10. DELIVER TO FOB POINT BY:
In accordance with Paragraph 6 of the Scope of Work

11. CHECK IF BUSINESS IS
☒ SMALL
☐ SMALL DISADVANTAGED
☐ WOMEN-OWNED

12. DISCOUNT TERMS
NET

13. MAIL INVOICES TO: Finance & Accounting Officer at issuing office

14. SHIP TO: Services for: CODE
U.S. Army Engineer Division, New England
ATTN: Geotechnical Engineering Branch
424 Trapelo Road
Waltham, MA 02254-9149

15. PAYMENT WILL BE MADE BY: CODE
Finance & Accounting Officer
U.S. Army Engineer Division, NE
424 Trapelo Road
Waltham, MA 02254-9149

MARK ALL PACKAGES AND PAPERS WITH CONTRACT OR ORDER NUMBER

16. TYPE OF ORDER

DELIVERY	X	This delivery order is subject to instructions contained on this side of form only and is issued ~~XXXXXXXXXXXXXXXXXX~~ in accordance with and subject to terms and conditions of above numbered contract.
PURCHASE		Reference your furnish the following on terms specified herein, including, for U.S. purchases.

General Provisions of Purchase Order on DD Form 1155r (EXCEPT CLAUSE NO. 12 APPLIES ONLY IF THIS BOX ☐ IS CHECKED, AND NO. 14 IF THIS BOX ☐ IS CHECKED); special provisions ; and delivery as indicated. This purchase is negotiated under authority of 10 USC 2304(a)(3) or as specified in the schedule if within U.S., its possessions or Puerto Rico; if otherwise under 2304(a)(6).

☐ If checked, Additional General Provisions apply; Supplier shall sign "Acceptance" on DD Form 1155r and return copies.

ACCOUNTING AND APPROPRIATION DATA/LOCAL USE
96X3123
CC119340ACC000 (BD) $43,934.00
CONTRACT

GEB STATUS AE/PS EJA/mc

18. ITEM NO.	19. SCHEDULE OF SUPPLIES/SERVICES	20. QUANTITY ORDERED/ ACCEPTED *	21. UNIT	22. UNIT PRICE	23. AMOUNT
	Furnish the necessary personnel and equipment to install test drains at North Springfield, Vermont in accordance with Attachment No. 1.	APPROX.			ESTIMATED
1.1	Geologist	200	HR	$42.00	$8,400.00
1.3	Per Diem - overnight stay	25	DAY	50.00	1,250.00
1.4	Mileage from Waltham, MA and return	180	MI	.35	63.00
2.1	Geotechnical Report	1	JOB	55% of Line Item 1.1	4,620.00

* If quantity accepted by the Government is same as quantity ordered, indicate by ✓ mark. If different, enter actual quantity accepted below quantity ordered and encircle.

24. UNITED STATES OF AMERICA
BY: STANLEY J. MURPHY, Lt. Col. CE, Deputy Division Engineer
CONTRACTING/ORDERING OFFICER

25. TOTAL $43,934.00
29. DIFFERENCES

26. QUANTITY IN COLUMN 20 HAS BEEN:
☐ INSPECTED ☐ RECEIVED ☐ ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS NOTED

27. SHIP. NO.
☐ PARTIAL ☐ FINAL

28. D.O. VOUCHER NO.

30. INITIALS

32. PAID BY

33. AMOUNT VERIFIED CORRECT FOR

DATE SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

31. PAYMENT
☐ COMPLETE ☐ PARTIAL ☐ FINAL

34. CHECK NUMBER

35. BILL OF LADING NO.

36. I certify this account is correct and proper for payment.
DATE SIGNATURE AND TITLE OF CERTIFYING OFFICER

37. RECEIVED AT	38. RECEIVED BY	39. DATE RECEIVED	40. TOTAL CONTAINERS	41. S/R ACCOUNT NUMBER	42. S/R VOUCHER NO.

STANDARD FORM 36 (REV. 7-73)
GENERAL SERVICES ADMINISTRATION
FPR (41 CFR) 1-16.101

CONTINUATION SHEET

REFERENCE NO. OF DOCUMENT BEING CONTINUED
Delivery Order No. 0005
to DACW33-87-D-0007

PAGE 2 OF

NAME OF OFFEROR OR CONTRACTOR
ATLANTIC TESTING LABORATORIES, LIMITED

ITEM NO	SUPPLIES/SERVICES	QUANTITY APPROX.	UNIT	UNIT PRICE	AMOUNT ESTIMATED
6.1	Mobilization and Demobilization	1	JOB	$1,100.00	$1,100.00
6.3	Mileage Manchester, NH and return	120	MI	1.15	138.
6.5	Standby time	40	HR	80.00	3,200.00
9.1	Bulldozer excavation and grading	8	HR	80.00	640.00
18.2	HX and 6 inch size	30	FT	30.00	900.00
19.5	HX size casing	20	FT	25.00	500.00
20.3	HX casing	20	FT	27.00	540.00
22.4	4 x 5½ size, double tube barrel	30	FT	75.00	2,250.00
35.1	Low Angle Drain Hole, 0-100 Ft	200	FT	46.50	9,300.00
35.2	Low Angle Drain Hole, 101-200 Ft	110	FT	62.50	6,875.00
36.2	2" Diameter PVC Screen	270	FT	15.00	4,050.00
37.2	2" Diameter PVC Pipe	40	FT	2.50	100.00
37.4	2" Diameter Threaded Plug	2	EA	4.00	8.00

ATTACHMENT NO. 1
GEB REQUISITION 88-18 - DACW 33-87-D-0007
DELIVERY ORDER NO.5
EXPLORATION INSTRUCTIONS

PROJECT: Test Drain Installation

SITE: North Springfield Dam, No. Springfield, VT

PURPOSE: To develop seepage relief techniques.

1. SCOPE OF INVESTIGATIONS:

a. Two drain holes, one 130 feet long and one 180 feet long, shall be bored at the locations shown on Attachment 2. Both holes shall be located by the inspector and drilled so that their directions of advance are as close as possible to those shown on Attachment 2.

b. Both holes shall be inclined so that their distal ends are at a 5-degree angle up from the horizontal plane relative to the point of entry.

c. Two-inch nominal, slotted (.014 in size), schedule 80, flush jointed pipe with end caps and sections of blank pipe shall be installed in the drain holes as shown in Attachment 3. Ten linear feet of HX casing used in drilling shall be left in place to protrude from the bank about 6 inches.

d. The inspector shall provide telephone reports to Mr. Tim Beauchemin, Corps of Engineers, at tel. (617) 647-8365 at least once every working day and upon encountering refusal or completion of each boring prior to drain installation. The alternate point of contact is Mr. John Hart at tel. (617) 647-8389.

2. SITE CONDITIONS.

Both holes are located in the downstream right abutment of North Springfield Dam. Subsurface conditions are presented in Attachment 3. Access is available from a road to the downstream toe of the dam and a causeway across a drainage channel. A bulldozer may be required to notch into the berm and/or provide a drilling platform. Some pumping of the seepage pool may be necessary.

3. COORDINATION.

The Contractor shall contact Mr. Tim Beauchemin, Corps of Engineers, at tel. (617) 647-8365 one week prior to the start of work. The field inspector shall give a daily telephone report on the progress of the work to Mr. Beauchemin. The Contractor shall also coordinate with Mr. Thomas Coen, Project Manager at North Springfield Dam, tel. (802) 886-7775.

4. EXPLORATIONS. (see exploration plan, Attachment 2)

Borings HW-A and HW-B shall be redesignated HW-88-1 and HW-88-2 in order of their completion.

5. GOVERNMENT REVIEW.

The Government will review the draft submittal as well as the completed work. Subsequent to such review, the Contractor shall accomplish any corrections which may be directed as the result of the Govenment review.

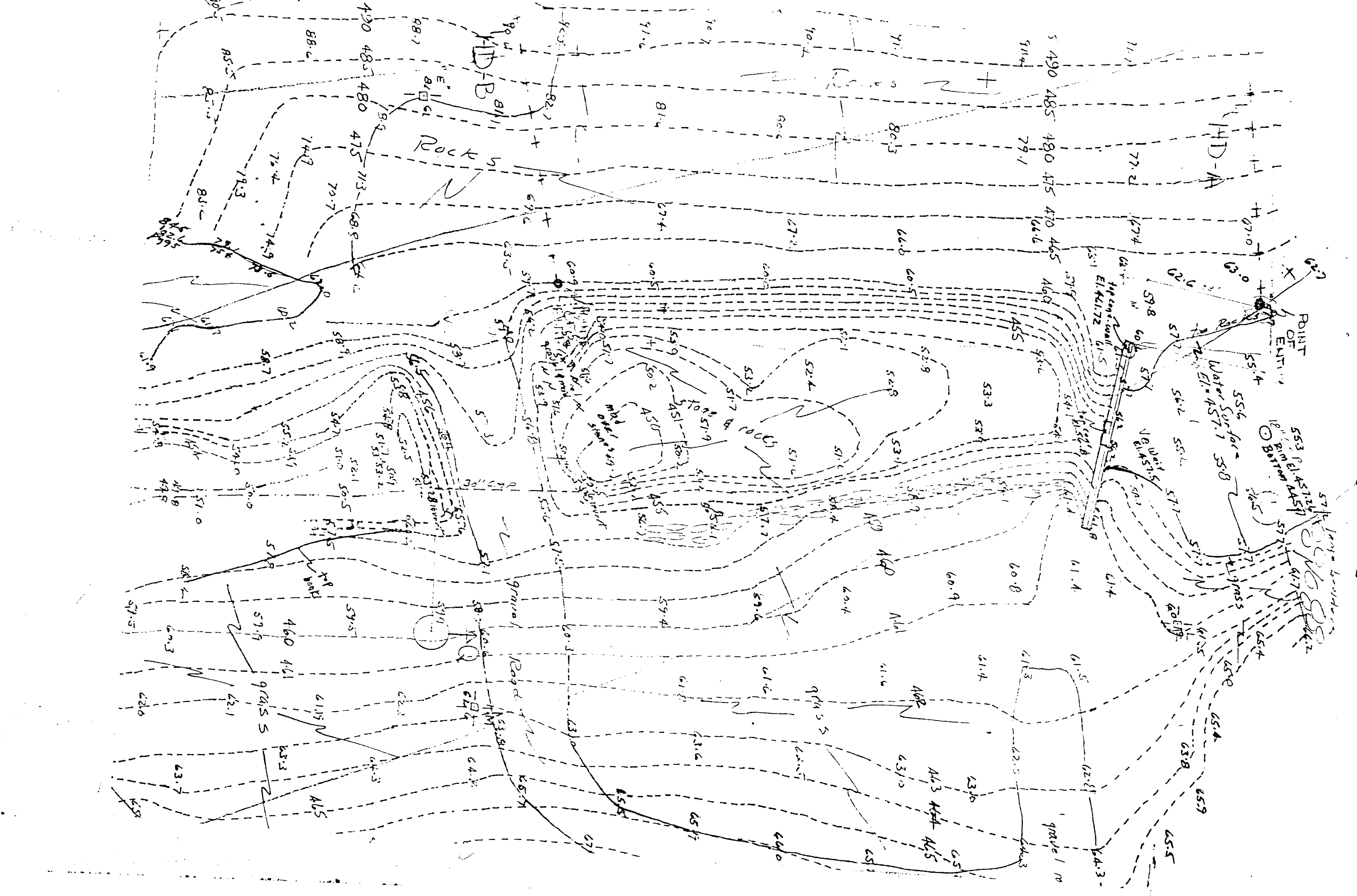
6. COMPLETION SCHEDULE.

Services under this delivery order shall start on or before 11 April 1988. Duration of the field work is estimated to be twenty-five days. The geotechnical report shall be submitted in draft format for review (by the Govenment), postmarked no later than seven calendar days after the completion of field work. Government review will take approximately ten calendar days from the receipt of the draft report. The final geotechnical report shall be submitted postmarked no later than seven calendar days after the receipt of the draft report with Government comments.

7. QUALITY CONTROL.

You will be held responsible for the quality of the maps submitted and for all damages caused the Government as a result of your negligence in the performance of any services furnished under the contract.

Although submissions required by your contract are technically reviewed by the Government, it is emphasized that your work must be prosecuted using proper internal controls and review procedures. The letter of transmittal for each submission which you make shall include a certification that the submission has been subjected to your own review and coordination procedures to insure (a) completeness for each discipline commensurate with the level of effort required for that submission, (b) elimination of conflicts, errors, and omissions, and (c) the overall professional and technical accuracy of the submission. Documents which are significantly deficient in any of these areas will be returned to you for correction and/or upgrading prior to our completing our review. Contract submission dates will not be extended if a resubmission of draft material is required for this reason.



HD-B
HD-A
Rocks
POINT OF ENT
Water Surface El. 457.1
30" CMP
Road
grass
gravel

b. Project Site

The low angle drain installation took place on the downstream right abutment of North Springfield Dam, Vermont. The low angle drains were located at the toe of the right abutment. The lower surface of the abutment, where the drains were installed, is covered with rip-rap. Access to one drain was obtained via a causeway that crosses a drainage channel at the toe of the right abutment. Access to the other drain was gained by crossing a shallow drainage pool above a concrete weir at the toe of the right abutment.

A General Project Map, Site Location Plan, and Boring Location Map are included in Section 8. A general plan of this site was provided to us in the Delivery Order, and is included in Section 3a.

c. Purpose

The purpose of this investigation was to develop seepage relief techniques by the use of horizontal drains, to be used in the downstream abutment area. These techniques are to be used as part of a program to solve the seepage and subsequent erosion problems in this area of the dam.

d. Scope of Work

Survey, inspection, exploration and drain installation instructions, which were provided by the Army Corps of Engineers, New England Division, through the contract Geotechnical Exploratory Work Various Locations in New England. Specific instructions and changes during the course of the work were given verbally during on-site and telephone conversations with USACE representatives. Details of new instructions can be found listed in Table II, Section 5 (Telephone Log). The main changes were (1) two drain holes, both approximately 150 ft long, were to be installed as opposed to two drains, one 130 ft and the other 180 ft; (2) 1-1/2" diameter PVC wire wound screen was used rather than a 2" diameter screen; and (3) 2" diameter galvanized steel pipe was used in lieu of HX casing as a protector pipe.

Drilling and drain installation was commenced by Atlantic Testing Laboratories personnel using Atlantic Testing Laboratories equipment and subsequently, Jeff Jensen and ATL personnel using Jensen's Drilling equipment. The drain holes were advanced and drain pipe installed as indicated on Attachment No. 1, Exploration Instructions, of the Delivery Order (Section 3a) and as outlined in the contract specifications and amended in the conversations outlined in Table II, Section 5.

SECTION 4

QUALITY CONTROL

a. General Certification Statement

I hereby certify that the records, equipment and procedures mentioned herein were used to perform the subsurface exploration described herein. I also certify that the work was performed in a professional manner and meets the requirements set forth in the delivery order. This report has been subject to my review and is both complete and technically accurate.

CERTIFIED JULY 8, 1988

Spencer F. Thew, P.E./L.S.

b. Records Taken

Pertinent drilling procedures are noted on the following forms provided for use by the Corps of Engineers:

NED 121 - Field Log of Test Boring, Summary
NED 58 and 58a - Field Log of Test Boring
NED 59 - Boring Location Sketch

Information outlining the installed drain characteristics were noted on the Drain Installation Detail. A completed series of logs for each of the borings is included in Section 7. The Boring Location Map is included in Section 7.

A Summary of Daily Activities and Telephone Logs are Tables I and II, respectively of Section 5. The Safety Meeting Reports, NED Form 251, including exposure time for Atlantic Testing Laboratories', USACE, and subcontract personnel, is included in Section 6.

c. Equipment Used

All equipment and supplies were provided by Atlantic Testing Laboratories, Limited, with the exception of that provided by sub-contractors. A listing of pertinent equipment follows:

1. Drilling Equipment

- CME 850 ATV drill rig
- HW and NW casing with spin shoes
- drill rod, NX taper threaded in 2 ft, 5 ft, and 10 ft lengths used for sampling and turning 3-7/8" roller bits
- 3" centrifugal pump with 500 ft of fire hose

Subcontracted Equipment

- Jensen-fabricated hydrostatic rotary drill
- 2" I.D. seamless steel pipe with API threaded box and pin ends welded to the ends of the pipe
- 3-7/8" roller bit

Survey Equipment

- hand level
- engineer's rule
- 100 ft fiberglass tape

d. Procedures

1. Survey Procedures

The boring locations and approximate elevations were determined by the inspector using a hand level, engineer's rule and measuring tape. The concrete weir at the toe of the dam was used as a reference point for both horizontal and vertical measurements.

The elevation of the top of the concrete weir as shown on USACE Drawing No. SUR-425 is 461.72 ft; this was used as a reference elevation. The location of each boring is shown on the boring location plan and the boring location sketches in Section 8; survey notes can be found in Section 9.

2. Drilling and Drain Installation Procedures

Five (5) low angle borings were performed at North Springfield Dam in completing the installation of two (2) low angle drains. Both the completed drains have 1-1/2" PVC drain pipes installed within them. The specially-built Jensen drill rig was used on four of the five borings, including the two completed borings. The CME 850 was used on the first boring.

The Jensen drill rig was best suited for advancing the low angle drain holes because of its design. The Jensen rig used a knockoff bit and no separate casing. The drill rod served as the casing for the drain pipe. The Jensen drill rig used a 3-7/8" roller bit to advance the boring and used drilling foam to hold the hole open and reduce friction between the boring wall and the outside of the casing.

Once the boring was advanced to the desired depth using the Jensen drill rig the drill rod was turned in the opposite direction as to what it had been turning in order to advance the hole, in doing this the bit was released from the end of the drill rod. The drain pipe (screen and solid PVC pipe) was then inserted into the drill rod and the drill rod was then extracted. The bore hole collapsed around the drain pipe, holding it in place. Finally, a 2" galvanized protective pipe was placed over the PVC drain to protect it against vandalism.

SECTION 5

DAILY ACTIVITY AND TELEPHONE LOG

TABLE I
Daily Activity Log

North Springfield, Vermont

Date	Activity
June 7, 1988 Tuesday	- Drill crew (Todd Burnham and Tom Stearns) on site 6 a.m. to 7 p.m. - Gurney Brothers had excavation equipment on-site 9 a.m. to 12:45 p.m. - Corps representative onsite 9:40 a.m. to open valve to dewater upper drainage pond. - Inspected previously installed piezometers and protective pipes that need to be grouted in place. One soil boring remains open and needs to be backfilled. - Setting drill rig up on drain hole HW-B(1) from 6 a.m. to 2:30 p.m.; began drilling at 2:30 p.m. - CME850 drill advanced casing very slowly to 20 ft; steady flow of groundwater coming from toe of the excavation. - 8 hours standby.
June 8, 1988 Wednesday	- Drill crew onsite 6:30 a.m. to 7 p.m. - G. Hargrave, ATL inspector, in transit to site. - Corps representatives, R. DeFilippo and T. Beauchemin, onsite 9 a.m. to 3 p.m., USACE representatives felt that too much rip-rap had been excavated. Point of entry was approximately 4 ft too high, however, the Corps accepted the location. - Advanced drain hole HW-B(1) to 34 ft.
June 9, 1988 Thursday	- G. Hargrave, ATL inspector, onsite 7 a.m. to 6:30 p.m.; drill crew onsite 6:30 a.m. to 6:30 p.m. - Weather - overcast, 60 degrees. - Hole HW-B(1) advanced to 40 ft. - 10 a.m. to 6:30 p.m. standby time, bearings in rig had to be replaced due to damage caused by drilling at 5 degree angle. - Mike Curran, USACE Basin Manager, was onsite and took pictures of seepage in excavated area; he did not think area was in imminent danger of collapse. - Performed falling head test on PZ-15 (FD88-3). - 8 hours standby to repair equipment.
June 10, 1988 Friday	- G. Hargrave, ATL inspector, onsite 8 to 11 a.m.; drill crew onsite 6:30 to 11 a.m. - Drill crew grouted protective casing for existing piezometers installed under D.O. 0003.

June 10, 1988 - Continued
Friday
- G. Hargrave, ATL Inspector, and drill crew shored up excavation per R. DeFilippo (USACE) request.
- 4.5 hours standby.

June 13, 1988
Monday
- G. Hargrave, ATL, inspector and drill crew onsite 12:30 to 7 p.m.
- Weather, hot and humid, 80 degrees.
- Drill crew set up torches and heated HW casing so extra piece could be removed to enable them to use telescoping techniques. Drill crew tooled up to use NW (3") casing, telescoped inside HW (4") casing. (12:30 -6 p.m.)
- Drill rig started excessive vibrations; crew removed universal joints for repair after checking other bearings. The universal joints were destroyed due to drilling at 5 degree angle.
- 6.5 hours standby for tooling up rig and rig repair.

June 14, 1988
Tuesday
- G. Hargrave, ATL inspector, and drill crew on-site 7 a.m. to 5 p.m.
- Weather, clear and hot, light winds.
- Crew replaced u-joint; drill rig was still making excessive noise when run at proper speed. Crew removed right angle drive and discovered its bearings were destroyed. No drilling performed on today's date.
- 8 hours standby time, rig repair.

June 15, 1988
Wednesday
- G. Hargrave, ATL inspector, and drill crew on site 9 a.m. to 6 p.m.
- Weather, hot, hazy, no wind, 90 degrees.
- Held safety meeting.
- Inspector and drill crew replaced locking cap with screw-on cap on PZ-15.
- Drill crew attempted to install right angle drive but base plate holes on new unit did not line up with rig holes. Richard Crawford, certified welder, inspected base plate and suggested we switch base plates rather than try to reweld the new plate.
- Drillers installed new right angle drive with old base plate.
- Rig was still making noise, apparently from different sources. Drilling at 5 degree angle appears too difficult for a drill rig of this design.
- 8 hours standby, rig repair.

June 16, 1988
Thursday

- G. Hargrave, ATL inspector, and drill crew onsite 7 to 9 a.m.
- Weather hot, 90 degrees.
- Drill crew removed bearings from gear box to determine the cause for the vibrations and noise that is being evidenced.
- 2 hours standby, rig repair.

June 20, 1988
Monday

- Paul Davis, ATL inspector, and drill crew onsite 1 to 5 p.m.
- Moved CME 850 around to side of dam to try several boom angles. Appears that boom must be at 35 degree angle from horizontal, or more, to run properly.
- 4 hours standby time, trying different boom angles.

June 21, 1988
Tuesday

- Paul Davis, ATL inspector, and drill crew onsite 7:30 a.m. to 12:30 p.m.
- Set CME850 back on hole; picked up site. It was decided that another type rig would be required to drill the drain holes if we were not to have continual maintenance problems.
- 5 hours standby time.

June 28, 1988
Tuesday

- Tom Pahler, ATL inspector, on site 10 a.m. to 8:30 p.m. ATL drill crew onsite 7 a.m. to 8:30 p.m. Jeff Jensen from Jensen Drilling Company onsite 7 a.m. to 8:30 p.m. Ron DeFilippo and T. Beauchemin, USACE, onsite 9 a.m. to 1:30 p.m.
- Mobilized drill rig to location of drain and set up rig (7 - 9:45 a.m).

- ATL drill crew and Jeff Jensen were advancing drain hole HW-A 1 using Jensen's drill rig.

- ATL drill crew attempted to remove HW casing from HW-B 1. Casing could not be turned; drill crew grouted casing in place.

- Drill crew started drilling Horizontal Boring HW-A 1. The following are notes regarding the drilling:

Depth	Time	Remarks
0'	9:45 a.m.	advanced through rubble surface cover
10'	-	-
20'	10:00 a.m.	drill chattering (cobbles), lost foam
30'	10:30 a.m.	return at 25'
40'	11:10 a.m.	cobbles
50'	11:20 a.m.	reduced quantity of foam
60'	11:30 a.m.	-

June 28, 1988 - Continued
Tuesday

Depth	Time	Remarks
70'	11:35 a.m.	added foam at beginning of run
80'	11:42 a.m.	torque pressure increased with slower progress starting at 83'
90'	12:00 p.m.	-
92'	12:00 p.m.	high torque pressure and increased drill fluid pressure, pulled all steel, found roller bit was plugged; cleared bit and drillers fabricated a check valve on roller bit
0'	2:00 p.m.	re-entered bore hole with check valve on roller bit
30'	2:10 p.m.	high drill fluid pressure, pulled steel and found check valve had failed and roller bit was plugged
0'	2:15 p.m.	re-entered with new roller bit and check valve
90'	2:45 p.m.	-
100'	2:51 p.m.	torque pressure increased
110'	2:58 p.m.	-
115'	3:05 p.m.	started pulling steel out to 80'
80'	3:25 p.m.	torque pressure reduced, started advancing steel
120'	4:10 p.m.	high torque pressure could not advance hole, pulled steel
	4:20 p.m.	lost lead drill rod and bit in hole
	4:25 p.m.	terminated hole at 120'

- -

- Horizontal Boring HW 88-1, HW-A 2, drilling notes:

Depth	Time	Remarks
0'	4:45 p.m.	relocated bore hole approximately 2' to the north, advanced hole with new bit and rebuilt check valve
10'	5:05 p.m.	-
20'	5:12 p.m.	-
30'	5:17 p.m.	foam is returning from embankment and from first bore hole
40'	5:45 p.m.	high torque pressure; to reduce pressure ran steel in and out

June 28, 1988 - Continued

Depth	Time	Remarks
50'	6:15 p.m.	-
60'	6:21 p.m.	-
70'	6:30 p.m.	-
80'	6:35 p.m.	no foam return
90'	6:43 p.m.	-
100'	6:54 p.m.	-
110'	7:00 p.m.	-
120'	7:12 p.m.	-
130'	7:20 p.m.	-
140'	7:30 p.m.	-
150'	7:37 p.m.	-
-	7:45 p.m.	set PVC screen and pipe (110' screen, 40' pipe) set galvanized 2" protective pipe (10')
	8:15 p.m.	boring completed

- 4.75 hours standby (bore hole move, cleaning bit, check valve fabrication)

June 29, 1988
Wednesday

- Tom Pahler, ATL inspector, onsite 7:30 a.m. to 8:30 p.m. ATL drill crew onsite 7 a.m. to 8:30 p.m.
- Move drill rig to drill location, set up, (7 - 10 am)
- Horizontal Boring HW-B 2 drilling notes:

Depth	Time	Remarks
0	10:00 a.m.	drill chattering, noted return of drill fluid from abutment
15'	10:15 a.m.	-
25'	10:25 a.m.	-
45'	11:00 a.m.	cobbles at 40'
55'	11:12 a.m.	chatter
65'	11:30 a.m.	lost drill foam
-	11:42 a.m.	slight return of drill foam
75'	12:06 p.m	pulled drill steel due to high torque and drill foam pressure
0	12:45 p.m.	re-enter bore hole
35'	1:05 p.m.	broke master link on drill feed cylinder
-	2:40 p.m.	start up, return of drill foam
45'	3:20 p.m.	difficult drilling due to cobbles
55'	3:40 p.m.	lost drill foam at 55'
65'	4:00 p.m.	-
75'	4:50 p.m.	high torque pressure, encountered boulders

June 29, 1988 - Continued
Wednesday

Depth	Time	Remarks
91'	5:30 p.m.	pulled steel to reduce pressure
-	6:20 p.m.	advanced steel
95'	6:50 p.m.	torque pressure increasing
110'	7:05 p.m.	terminate hole due to increasing torque pressure and risk of losing drill rods
-	7:15 p.m.	set screen, had trouble with bit detachment, started pulling drill steel, broke well screen, lost drill bit and 8' of well screen and the bore hole

- 4.5 hours standby (bore hole move and repairing master link)

June 30, 1988
Thursday

- Tom Pahler, ATL inspector, onsite 8 a.m. to 3:30 p.m. ATL drill crew onsite 7:30 a.m. to 3:30 p.m.
- Mobilize drill and set up on bore hole (7:30 - 8 a.m.)
- Held safety meeting
- Drill crew prepared drill bits and check valve assembly and rearranged drill steel so steel with buttons are set up to be in lead in hole in an attempt to ream bore hole to reduce torque resistance.

- Horizontal Boring HW 88-2, HW-B 3, drilling notes:

Depth	Time	Remarks
0	8:35 a.m.	relocated boring one foot north of HW-B 2
10'	8:45 a.m.	-
20'	8:50 a.m.	drill foam return from abutment
30'	9:00 a.m.	-
40'	9:14 a.m.	-
50'	9:28 a.m.	-
60'	9:40 a.m.	-
70'	10:00 a.m.	-
80'	-	-
90'	10:35 a.m.	-
100'	-	increased the concentration of drill foam; it apparently stabilizes bore hole and reduces torque pressures
120'	11:36 a.m.	-
130'	12:10 p.m.	-
140'	12:35 p.m.	-

June 30, 1988 - Continued
Thursday

	Depth	Time	Remarks
	-	12:40 p.m.	detach bit, set screen and solid pipe (110' screen and 40' solid pipe); pull drill steel and set 20' galvanized protective pipe (10' in abutment, 10' outside embankment)
	-	2:15 p.m.	bore hole and drain construction completed

- 0.5 hours standby (bore hole move)

July 1, 1988
Friday

- Gurney Brothers onsite with CAT936 loader, repair slope where excavation had been made (4 hours).

TABLE II
Daily Telephone Log

North Springfield, Vermont

Date	Conversation
May 12, 1988 Thursday	- 10:45 a.m., R. DeFilippo, USACE, to Spencer Thew, ATL. R. DeFilippo, USACE, called to inform S. Thew, ATL, that Delivery Order No. 5 for horizontal drains should be received in the near future. R. DeFilippo, USACE, indicated that the size pipe to be used is as follows: 1-1/2" diameter PVC pipe 80 l.f. of blank Schedule 80 pipe 270 l.f. of 0.014" slotted screen R. DeFilippo, USACE, said that the pipe size indicated on the Delivery Order was 2", however, 1-1/2" is correct. He also said the horizontal drains will be at a 5 degree up angle; one boring will be 200 ft deep and the other 150 ft deep. R. DeFilippo, USACE, indicated that they had been talking to Jensen Drilling Company, Alcoa, Tennessee and had spoken to the President. (Jeff Jensen phone number 615/984-4627.) R. DeFilippo, USACE, indicated that Jensen had information on knockoff bits which would facilitate the installation of the drain. S. Thew, ATL, told R. DeFilippo, USACE, that ATL would contact Jensen Drilling to discuss their procedures.
June 3, 1988 Friday	- 11:30 a.m., R. DeFilippo, USACE, to S. Thew, ATL. R. DeFilippo, USACE, called to verify the quantities of pipe required for piezometer installation. The requirements were 110 l.f. of screen for both borings HDA and HDB, and each will require 40 l.f. of solid pipe. R. DeFilippo then indicated that HDA would require 20 l.f. of HW casing to be left in place and HDB would require 30 l.f. of HW casing to be left in place. R. DeFilippo, USACE, reaffirmed that the slot size would be 0.014 inches.

June 3, 1988 - Continued
Friday

S. Thew, ATL, requested that we be allowed to work a 12-hour day since it was summer months with plenty of daylight. R. DeFilippo, USACE, said he did not see a problem with that, however, he would have to check into it and get back to ATL regarding a decision.

June 6, 1988
Monday

- 8:00 a.m., S. Thew, ATL, to Tim Beauchemin, USACE.

Tim Beauchemin, USACE, was not in. S. Thew, ATL, spoke with R. DeFilippo, USACE, and discussed the possibility of excavating the rock fill on the face of the dam in order to enchance the drilling effort. R. DeFilippo, USACE, indicated that the area around the downstream hole (HDB) was being proposed for reconstruction and excavation of all the rock in this area was alright. Consideration will have to be given to maintaining stability of the excavation. R. DeFillippo, USACE, was not sure of the upstream horizontal hole and was going to check and call back.

- 9:10 a.m., R. DeFilippo, USACE, to S. Thew, ATL.

R. DeFilippo, USACE, indicated that the rock fill in the area of HDA could be removed, however, reconstruction is not planned in this area. Therefore, ATL would have to return the slope to the original condition if the slope were disturbed.

R. DeFilippo, USACE, gave ATL blanket approval on a 12-hour day, we do not have to report hours to him unless there is something unusual.

June 9, 1988
Thursday

- 10:30 a.m., G. Hargrave, ATL, to R. DeFilippo, USACE.

R. DeFilippo, USACE, is going to send mylar of site plan to Canton.

R. DeFilippo is quite concerned about slope failure and wants G. Hargrave, ATL, to monitor seepage from abutment area.

June 10, 1988
Friday

- 8:30 a.m., G. Hargrave, ATL, to R. DeFilippo USACE.

R. DeFilippo requested that drill crew shore-up excavation.

June 10, 1988 - Continued
Friday

R. DeFilippo will be onsite Tuesday.

R. DeFilippo informed G. Hargrave that time spent with tow truck on Thursday cannot be billed.

June 14, 1988 - G. Hargrave, ATL to R. DeFilippo, USACE.
Tuesday

R. DeFilippo, USACE, informed G. Hargrave, ATL, that he would not be onsite today. Yuri Yatsevitch will be his phone contact for the remainder of the week and can be reached at 617/647-8387. Y. Yatsevitch may stop at job site later in week.

G. Hargrave, ATL, told R. DeFilippo that the shoring was more of a safety hazard than anything, therefore, it was taken down.

R. DeFilippo requested that regular drill logs be kept on the borings.

June 15, 1988 - G. Hargrave, ATL, to Y. Yatsevitch, USACE.
Wednesday

G. Hargrave, ATL, gave Y. Yatsevitch, USACE, a job update and told him that drillers were repairing drill rig.

June 16, 1988 - 8:30 a.m., G. Hargrave, ATL, to Y. Yatsevitch,
Thursday USACE.

G. Hargrave, ATL, told Y. Yatsevitch, USACE, that drill crew is working on different problem with drill rig. Also, drill crew will shore-up excavation before leaving site.

June 21, 1988 - 9 a.m., Tim Beauchemin, USACE, to P. Davis,
Tuesday ATL

P. Davis talked to T. Beauchemin about the possibility of bringing another rig to the job. T. Beauchemin said if we pulled off hole, the excavation must be filled with fine stone that is on the site.

June 21, 1988 - 9:10 a.m. - Spencer Thew, ATL, to Ron
Tuesday DeFillipo, USACE

- R. DeFilippo, USACE, was not in; S. Thew, ATL, talked to Yuri Yatsevitch, USACE, and told him that we were having mechanical problems with the rig and that we were in the process of trying to solve them. S. Thew, ATL, indicated

June 21, 1988 - Continued
Tuesday

that we would have more answers late in the day and would call R. DeFilippo, USACE, back on June 22.

June 22, 1988
Wednesday

- 8:15 a.m. Spencer Thew, ATL, to Ron DeFilippo, USACE
- R. DeFilippo, USACE, was not in; S. Thew, ATL, asked for Y. Yatsevitch, USACE, who was not available. S. Thew, ATL, then asked for John Hart, USACE. John Hart, USACE, got Tim Beauchemin, USACE, on the phone for a conference call.

S. Thew, ATL, said that basically we had three alternatives, (1) continue drilling with our rig which had advanced the hole to 40 ft, however, this resulted in substantial mechanical damage to the rig. S. Thew explained that with the rig drilling in a horizontal position, it was very rough on the universal joints and right angle drive since we were transferring the power at two 90 degree angles. CME had told ATL that the drill rig would drill horizontally which is correct. However, there is a lot of wear and tear on the drill rig. (2) Rent a Hole Gator which we have located in New Jersey. When ATL rents the Hole Gator, ATL has to take it in an as-is condition and S. Thew, ATL, is somewhat concerned about mechanical failures and delay of the project. The Hole Gator is made by Acker Drill and designed specifically to drill horizontal holes. (3) Get Jeff Jensen from Alcoa, Tennesee to provide a drill rig. It is our understanding that a rig is currently available and ATL will have to take our low-boy trailer down to Tennesee to pick up the rig. Mr. Jensen himself would come up and work with our drill crew and feels they can complete the project in less than a week. S. Thew, ATL, recommended that we go with alternative (3) and J. Hart, USACE, concurred.

S. Thew, ATL, then discussed that installing a protective pipe with this type of rig may be very difficult. We are currently working on these details.

S. Thew suggested that we excavate around the drain pipe at the surface of the slope. We would then place a concrete encasement, which would have a steel protective pipe inserted around the drain pipe. This would certainly protect the pipe from vandalism which is a

concern of the Corps of Engineers. J. Hart, USACE, said that this procedure was acceptable on the upstream hole since no reconstruction was to be performed in this area. However, this may not be acceptable on the downstream holes since this area would be reconstructed. J. Hart, USACE, then said that maybe we could move the upstream hole slightly out of the area of reconstruction. If this was the case, then the concrete encasement would be acceptable. J. Hart, USACE, was to check on this and let us know if in fact we could relocate the hole. We are to start drilling the upstream hole first.

S. Thew, ATL, indicated that we were currently attempting to schedule the project to begin drilling on Tuesday, June 28. J. Hart, USACE, said this would be acceptable.

June 27, 1988
Monday

- 11:55 a.m. - Spencer Thew, ATL, to Ron DeFillipo, USACE

- S. Thew, ATL, informed R. DeFilippo, USACE, that we were mobilizing to the site today and everything appears to be going timely.

Tomorrow we will be removing the HW casing in the initial drill hole and starting the horizontal drill holes. S. Thew, ATL, asked R. DeFilippo, USACE, if it was necessary to place any grout in the existing horizontal hole or just allow it to collapse as we extruded the casing. R. DeFilippo, USACE, said it would be fine to extrude the casing. R. DeFilippo, USACE, said we should immediately make arrangements to start cleaning up the area at the toe of the dam.

S. Thew, ATL, told R. DeFilippo, USACE, that Tom Pahler, ATL, would be the geotechnical inspector for the first couple of days (Tuesday and Wednesday) since Greg Hargrave, ATL, was out due to illness.

R. DeFilippo, USACE, said that he and Tim Beauchemin, USACE, would be onsite Tuesday.

June 29, 1988
Wednesday

- 7:55 a.m. - T. Pahler, ATL, to T. Beauchemin, USACE

T. Pahler, ATL, told T. Beauchemin, USACE, that the first boring was completed and we were proceeding to the next hole.

June 29, 1988 - Continued
Wednesday

T. Beauchemin, USACE, asked if drill crew could loosen and grease the steel piezometer caps and grout the cancelled boring. T. Pahler, ATL, said yes.

T. Pahler, ATL, discussed problems accessing second boring due to steep banks and water depths. It was proposed that the boring be advanced in the area of the existing HW cased boring and be located as low and as close to the proposed location as possible. T. Beauchemin, USACE, agreed the boring should be performed where it can be advanced.

- 9:50 a.m. - T. Pahler, ATL, to T. Beauchemin, USACE, regarding hole depths due to excavation.

T. Beauchemin, USACE, said hole should be advaneced a net 140' from the excavated face. It is the USACE's intention to bring the slope back to the old grade which would require the PVC and galvanized protective pipes to be a sufficient length to protrude from the final slope.

T. Pahler, ATL, was concerned that too much pipe overlay at this time may hinder backfilling of excavated embankment. Mr. Beauchemin, USACE, acknowledged this and expressed that it would not be of significant concern.

June 30, 1988
Thursday

- 3 p.m. - T. Pahler, ATL, to T. Beauchemin, USACE

T. Pahler, ATL, told T. Beauchemin, USACE, that the project is complete, site is cleaned up, drill crew could not grout unsuccessful bore holes due to cave-ins and he will inform Gurney Brothers that site is ready for backfill.

July 1, 1988
Friday

T. Pahler, ATL, to T. Beauchemin, USACE
T. Pahler, ATL, asked if Gurney Brothers Construction had been in contact with USACE regarding backfilling embankment excavation. T. Beauchemin, USACE, indicated that Gurney Brothers Contruction had contacted him.

SECTION 6

SAFETY REPORTS

WEEKLY SAFETY MEETING

NEDSO

Date held 15 June 88

FROM: Area Engineer, New England Area

Time AM

TO: Safety Office, NED

Report No. 1

1. Weekly safety meeting was held this date for the following personnel:

Contract No. /D.O.No. 0005 Contractor Atlantic Testing Laboratories, Ltd.

Conducted By Greg Hargrave All personnel present (Contr) 3
(Sub) -0-
(Govt) -0-

Subjects discussed (Note, delete, or add):
EM 385-1-1, Section: _____

Accident Prevention Plan

✓Individual Protective Equipment - Hard Hat, safety shoes

✓Prevention of Falls - watch slopes

✓Back Injury, Safe Lifting Techniques - use proper lifting techniques

Fire Prevention -

✓Sanitation, First Aid, Waste Disposal - Keep work area neat

Tripping Hazards - trash, hose, nails in lumber -

Staging, Ladders, Concrete Forms, Safety Nets -

Hand Tools, Portable Power Tools, Woodworking Machinery -

✓Equipment Inspection & Maintenance (Zero Defects) -

✓Hoisting Equipment - Zero defects

✓Ropes, Hooks, Chains and Slings - Zero defects

Electrical Grounding, Temporary Wiring, GFCI -

Lockouts for safe clearance procedures - electrical, pressure, moving parts -

✓Welding, Cutting - use eye protection

✓Excavations -

✓Loose Rock and Steep Slopes -

Explosives -

Water Safety -

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

Prepared by Gregory R. Hargrave Title Geologist

2. Forwarded.

Signature Gregory R. Hargrave
Resident Engineer

CF: EXPOSURE HOURS:
Work Date: 6/7, 6/8, 6/9, 6/10, 6/13, 6/14, 6/15, 6/16
Non-work Date: 6/11, 6/12, 6/17

Man Hours:
Contr: 161.5
Subcontr: 3.75
Govt: 12
TOTAL:: 177.25

NED Form 251

WEEKLY SAFETY MEETING

Date held 6-30-88

NEDSO

THRU: Area Engineer, _____ Area

Time 6:08

TO: Safety Office, NED

Report No. _____

1. Weekly safety meeting was held this date for the following personnel:

Contract No. /D.O.No. _____ Contractor Atlantic Testing Laboratories, Ltd.

Conducted By _____ All personnel present (Contr) ✓
(Sub) ✓
(Govt) _____

Subjects discussed (Note, delete, or add):
EM 385-1-1, Section: _____

Accident Prevention Plan X

Individual Protective Equipment -

Prevention of Falls - X

Back Injury, Safe Lifting Techniques - X

Fire Prevention -

Sanitation, First Aid, Waste Disposal - ok

Tripping Hazards - trash, hose, nails in lumber -

Staging, Ladders, Concrete Forms, Safety Nets -

Hand Tools, Portable Power Tools, Woodworking Machinery -

Equipment Inspection & Maintenance (Zero Defects) -

Hoisting Equipment -

Ropes, Hooks, Chains and Slings -

Electrical Grounding, Temporary Wiring, GFCI -

Lockouts for safe clearance procedures - electrical, pressure, moving parts -

Welding, Cutting -

Excavations - X

Loose Rock and Steep Slopes - /

Explosives -

Water Safety -

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

Prepared by _____ Title _____

2. Forwarded.

Signature _____
Resident Engineer

CF: EXPOSURE HOURS:
Work Date: 6/20, 6/21, 6/28, 6/29, 6/30
Non-work Date: 6/22, 6/23, 6/24, 6/25, 6/26
6/27

Man Hours:
Contr: 142
Subcontr: 35
Govt: 11
TOTAL: 188

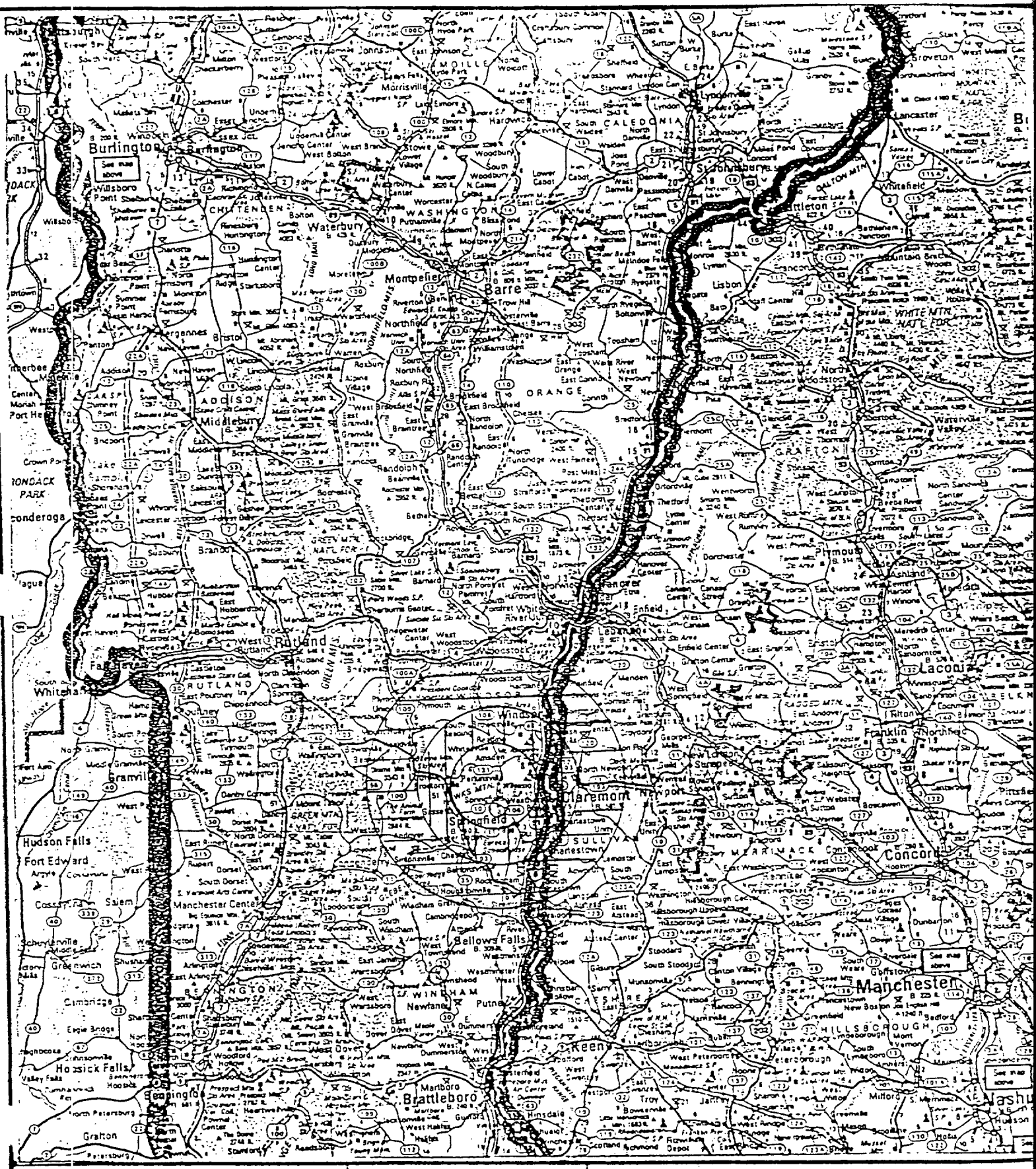
NED APP FL F2 251

SECTION 7

FIELD INSPECTORS' LOGS

a. Figure 1 - General Project Map

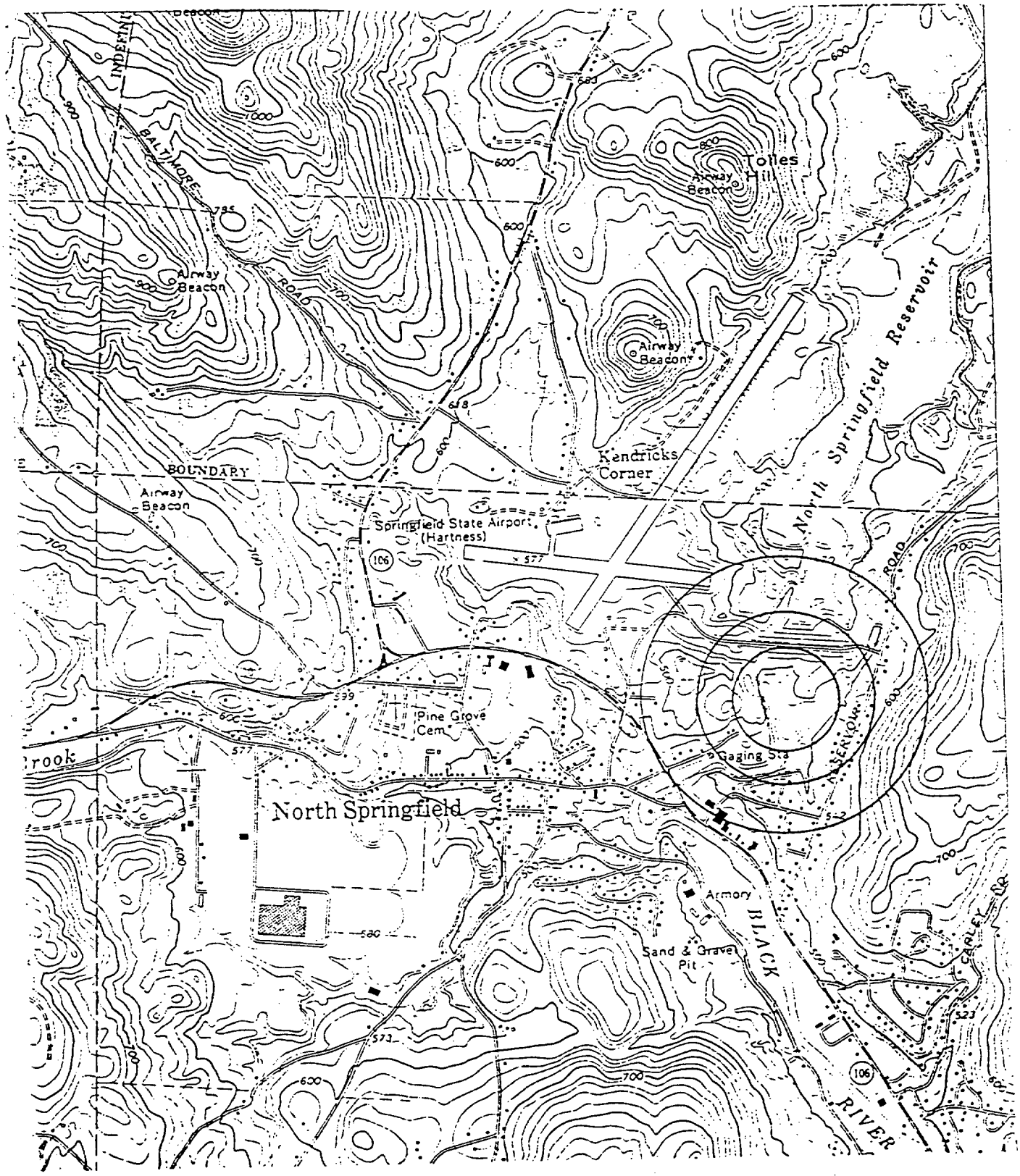
GENERAL PROJECT MAP



PROJECT No	SCALE:	
CD032	NONE	North Springfield, Vermont

b. Figure 2 - Site Location Map

SITE LOCATION MAP

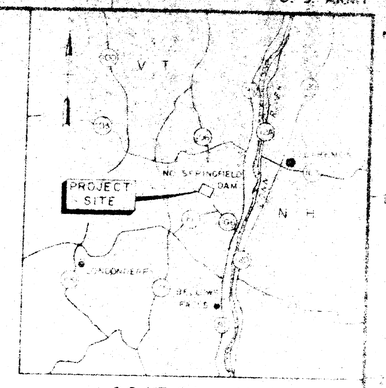


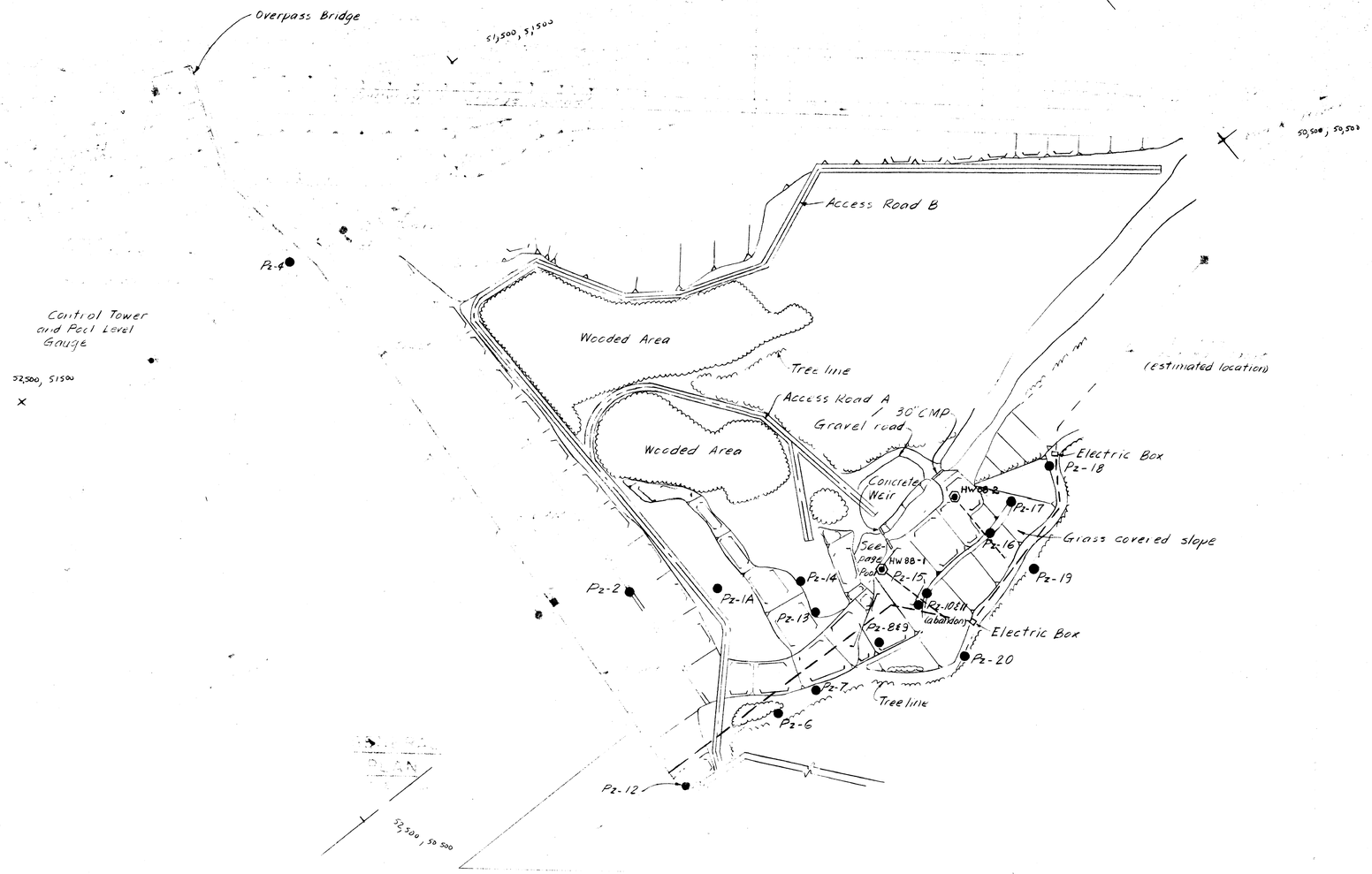
PROJECT No. CD032	SCALE: 1:24000	U.S.G.S. QUADRANT: USGS Quadrant Chester, Vermont

K-

c. Figure 3 - Boring Location Map

U. S. ARMY





LEGEND

● Pz-7	Existing piezometer
■ B	Strong motion shelter
	Earth filled slope with stone protection
	Tree line
◉ HW-1	Completed Test Drains

GRAPHIC SCALES

0 100 200

SAFETY PAYS

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM MASS

DES. BY	CH. BY
SUBMITTED	
DESIGN ENGINEER	
APPROVAL RECOMMENDED	
CHIEF, DESIGN SECTION	
APPROVED	
CHIEF, ENGINEERING BRANCH	

WATER RESOURCES DEVELOPMENT PROJECT
CONNECTICUT RIVER BASIN
NORTH SPRINGFIELD LAKE
INSTRUMENTATION LAYOUT
BLACK RIVER VERMONT

APPROVED
CHIEF, ENGINEERING DIVISION
DATE MARCH 1988

SCALE 1" = 100' | SPEC. NO. DACW33-
DRAWING NUMBER
SHEET 1

d. Boring Logs

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. D.O. 0005

Site North Springfield Dam — Page 1 of 4 Pages

Hole No. HW-AL Diam. (Casing) — — Boring Started 28 June 88

Co-ordinates: N _____ E _____ — Boring Completed 28 June 88

Drilled by Jensen Burnham — Report Submitted 8 July 88

Purpose of Exploration To develop seepage relief techniques

Elevation Top of Hole 460.5 M.S.L. — Casing Left in Place 0 Feet

Total Overburden Drilled 120 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole — M.S.L.

Total Rock Drilled — Feet

Total Depth of Hole 120 Feet

Core Recovered — %

Core Recovered — Ft.; — Diam. — In.

Soil Samples — In. Diam. — No.

Soil Samples — In. Diam. — No. — Water Table Depth —

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	120	Advanced 3⅜" roller bit using drilling foam as drill fluid

INDEX

Prepared by Tom Palher — Field Data — Lab. Data —

Submitted by Atlantic Testing Laboratories Limited

NED FORM DEC 63 121 — REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site North Springfield Dam Vt Page 2 of 4 Pages

Boring No. HW-A1 Desig. HW-A1 Diam. (Casing) —

Co-ordinates: N _____ E _____

Elevation Top of Boring 460.5 M.S.L.
Total Overburden Drilled 120 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled — Feet
Elevation Bottom of Boring — M.S.L.
Total Depth of Boring 120 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft : — Diam. — In.
Soil Samples — In. Diam. — No.
Soil Samples — In. Diam. — No.

Hammer Wt. — Boring Started 28, June 88
Hammer Drop —
Boring Completed 28, June 88
Casing Left —
Subsurface Water Data — Page —
Obs. Well —
Drilled By Jensen, Burnham
Mfg. Des. Drill Jensen drill rig
Inspected By: Tom Palher
Classification By: —
Classification By: _____

DEPTH 1"= 10'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
					Advanced 4" casing using 3 7/8" roller bit and drilling foam to 92'	Granular Material (Gravel, cobbles)
10'						
20'					lost drilling foam at 25'	
30'						
40'						
50'						

GENERAL REMARKS:
Hole was advanced at approximately 5° up from horizontal

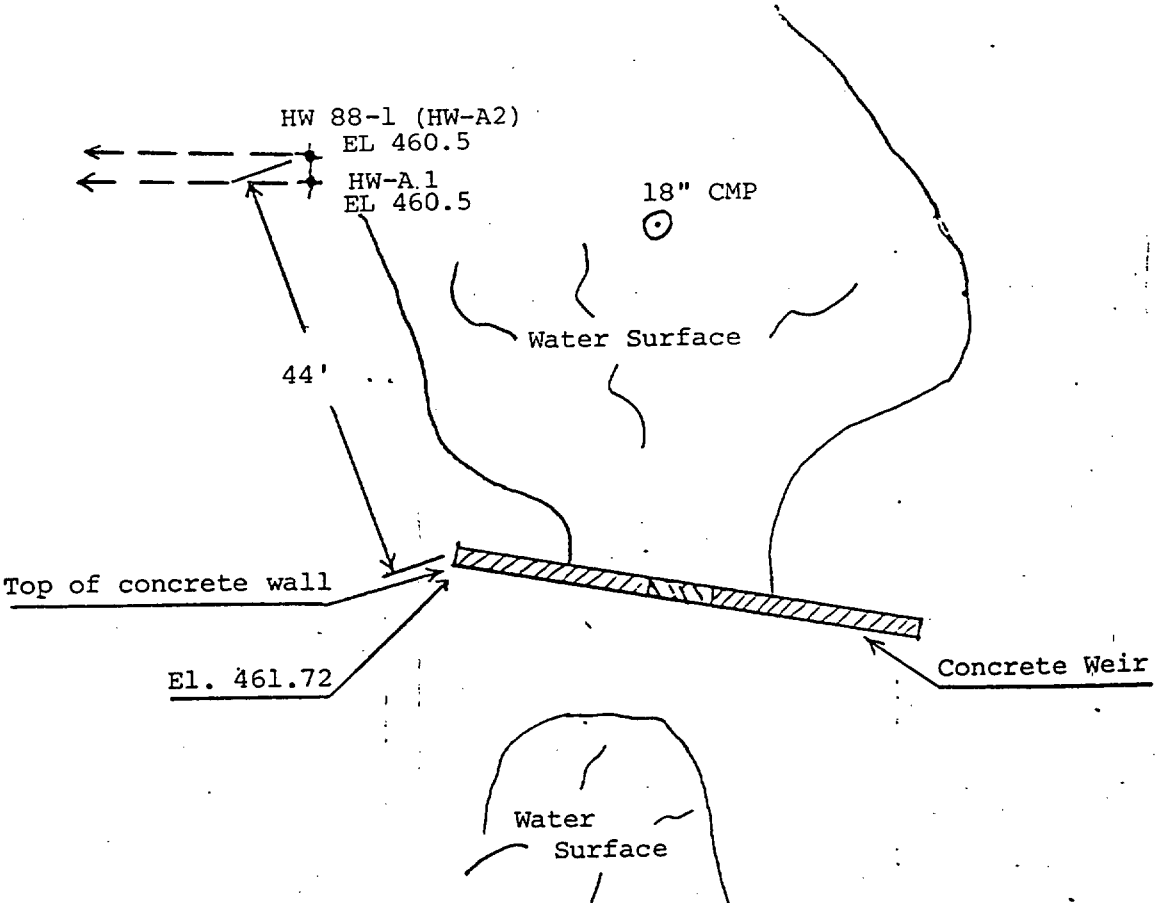
Site	Boring No.	Page 3 of 4
North Springfield Dam	HW - A1	

DEPTH	CORE/SAMPLE			BLOWS PER FT.	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	NO.	SIZE	DEPTH RUN	CORE RECVY		
60'						
70'						
80'					torque pressure increased with slower progress at 83'	
90'					Drillers pull casing at 92' to clean bit and replace checkvalve	
100'					Drillers re-enter boring advancing to 30', pull steel again and replace checkvalve and clean roller bit.	
110'					Drillers re-enter boring encounter high torque pressures at 115ft. Pull back to 80', then advance hole to 120'	
120'					encounter high torque pressures again, attempt to pull steel, drillers loose lead drill rod and bit	
					END OF EXPLORATION - 28. June 88	

Note:
Hole was not used for drain installation due to loss of steel down hole. Hole caved-in after part of steel was removed. New hole was started 2' to the North of old hole

BORING LOCATION SKETCH

North Springfield Dam
D.O. 0005
ATL Project CD032-88



Scale: 1" = 20'

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. D.O. 0005

Site North Springfield Dam — Page 1 of 6 Pages

Hole No. HW 88-1 (HW-A2) Diam. (Casing) 2" ϕ galvanized steel pipe — Boring Started 28 June 88

Co-ordinates: N _____ E _____ — Boring Completed 28 June 88

Drilled by Jensen, Burnham — Report Submitted 8 July 88

Purpose of Exploration To develop seepage relief techniques

Elevation Top of Hole 460.5 M.S.L.
Total Overburden Drilled 150 Feet
Elevation Top of Rock — M.S.L.
Elevation Bottom of Hole — M.S.L.
Total Rock Drilled — Feet
Total Depth of Hole 150 Feet
Core Recovered — %
Core Recovered — Ft.; — Diam. — In.
Soil Samples — In. Diam. — No.
Soil Samples — In. Diam. — No.

Casing Left in Place 10', 2" ϕ galvanized steel pipe Feet

Water Table Depth —

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	150	Advanced 3 3/8" roller bit using drill foam as drilling fluid

INDEX

Prepared by Tom Palher — Field Data — Lab. Data

Submitted by Atlantic Testing Laboratories, Limited

NED FORM DEC 63 121 REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site North Springfield Dam — Page 2 of 6 Pages

Boring No. HW 88-1 Desig. HW-A2 Diam. (Casing) 2" ϕ galvanized steel pipe

Co-ordinates: N _____ E _____

Elevation Top of Boring 460.5 M.S.L. — Hammer Wt. — — Boring Started 28 June 88

Total Overburden Drilled 150 Feet — Hammer Drop — — Boring Completed 28 June 88

Elevation Top of Rock — M.S.L. — Casing Left 10' of 2" ϕ galvanized steel pipe

Total Rock Drilled — Feet — Subsurface Water Data — — Page —

Elevation Bottom of Boring — M.S.L. — Obs. Well —

Total Depth of Boring 150 Feet — Drilled By Jensen, Burnham

Core Recovered — % No. Boxes — — Mfg. Des. Drill Jensen drill rig

Core Recovered — Ft : — Diam. — In. — Inspected By: Tom Palher

Soil Samples — In. Diam. — No. — Classification By: —

Soil Samples — In. Diam. — No. — Classification By: —

DEPTH 1"=10'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
					Advanced 4" casing using 3 7/8" roller bit and drill foam	
10'						
20'						
30'						
40'					foam return, from embankment near bore hole and from bore hole HW-A,	
50'						

GENERAL REMARKS:
hole was advanced at ± 5° angle up from horizontal

Site	Boring No.	Page 3 of 6
North Springfield Dam	HW-88-1 (HW-A2)	

DEPTH	CORE/SAMPLE			BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 10'	NO.	SIZE	DEPTH RUN			
50'					high torque pressures, drillers ran steel in and out	
60'						
70'						
80'						
90'					No foam return	
100'						
110'						
120'						
130'						

Site: North Springfield Dam

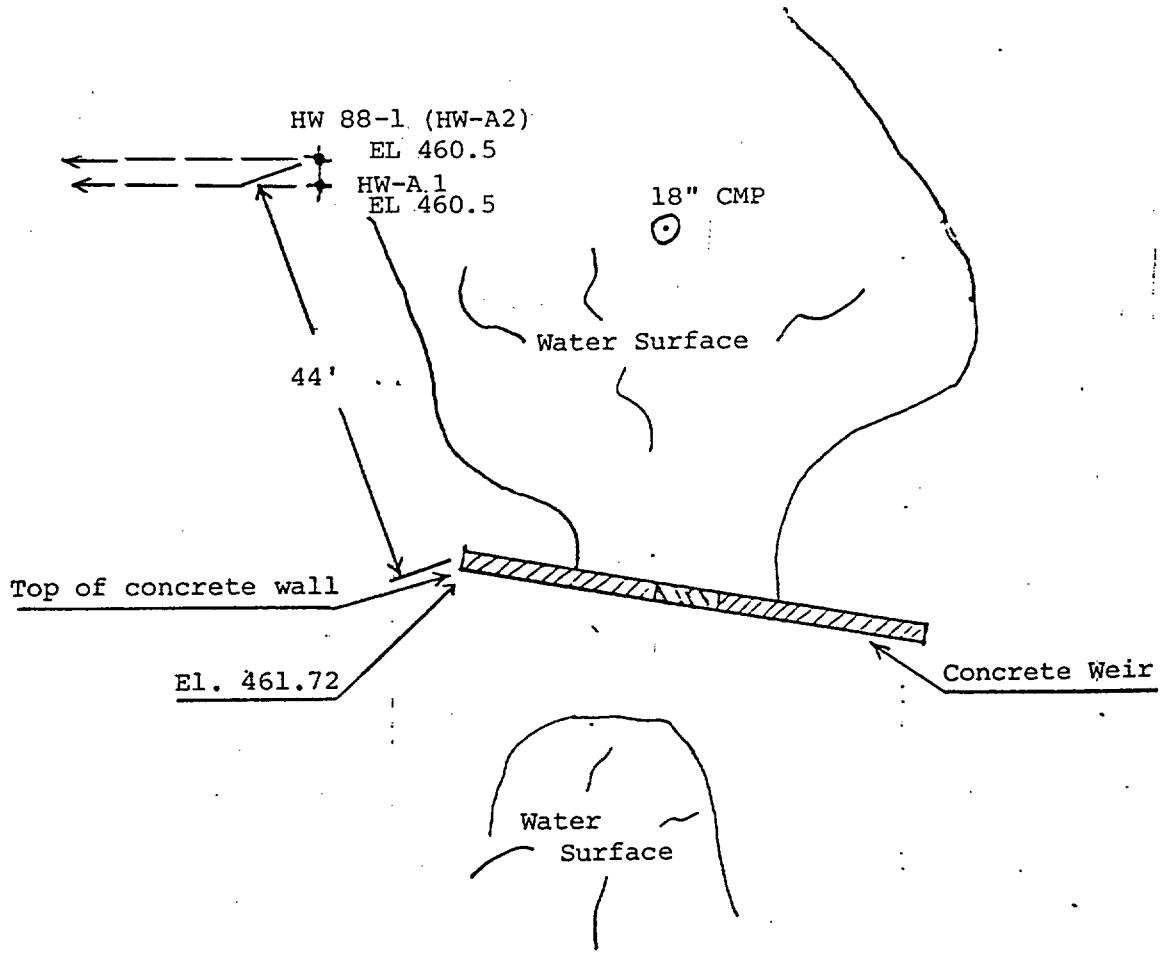
Boring No.: HW 88-1 (HW A2)

DEPTH	CORE/SAMPLE NO.	CORE/SAMPLE SIZE	CORE/SAMPLE DEPTH RANGE	BLOWS PER FT. / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
140'						
150'					END OF EXPLORATION 28 Jun 88	

Note: a 1½" Ø drain was installed in this boring, see drain installation detail

BORING LOCATION SKETCH

North Springfield Dam
D.O. 0005
ATL Project CD032-88

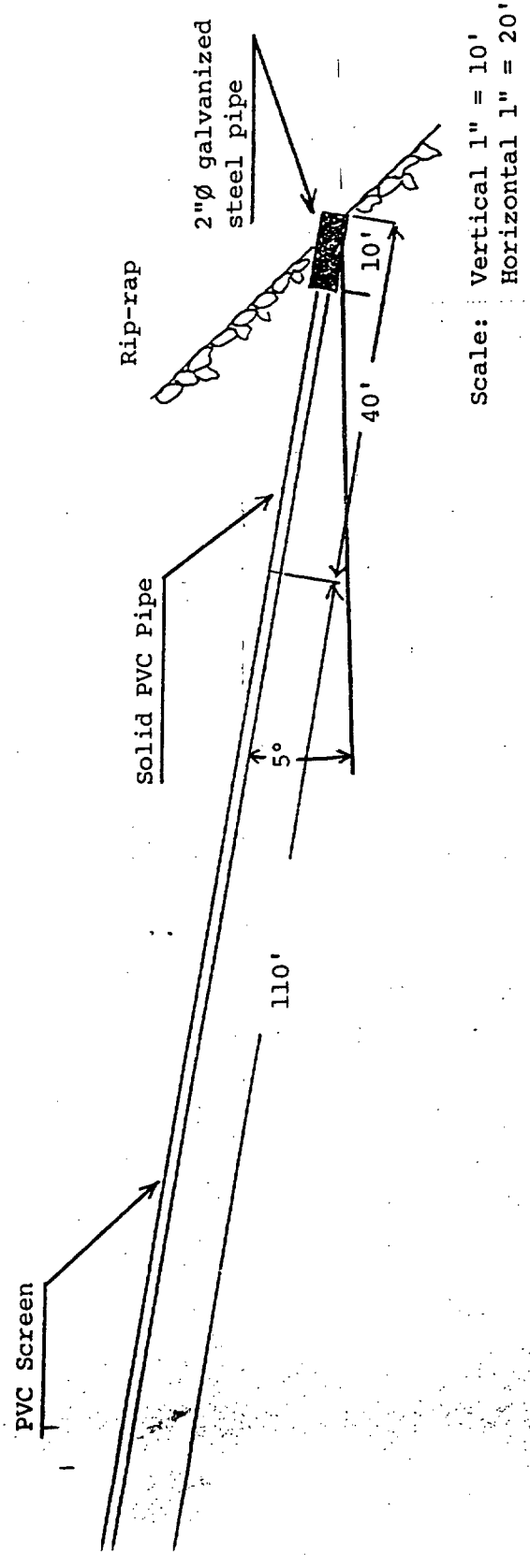


Scale: 1" = 20'

ATLANTIC TESTING LABORATORIES, Limited

SUBJECT	JOB NO.	BY	DATE	SHEET
Drain Installation Detail North Springfield Dam, VT	D.O. 0005 CD032-88	GH	7-7-88	Page 6

HW 88-1 (HW-A2)



CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. D.O. 0006

Site North Springfield Dam — Page 1 of 5 Pages

Hole No. HW-B1 Diam. (Casing) HW(4") / NW(3") — Boring Started 7, June 88

Co-ordinates: N _____ E _____ — Boring Completed 9, June 88

Drilled by Todd Burnham and Tom Stearns — Report Submitted 8, July 88

Purpose of Exploration Install a horizatal drain to provide seepage relief

Estimated
Elevation Top of Hole 463.0 M.S.L. — Casing Left in Place 40 Feet

Total Overburden Drilled 40 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole — M.S.L.

Total Rock Drilled NA Feet

Total Depth of Hole 40 Feet

Core Recovered NA %

Core Recovered NA Ft.: ____ Diam. ____ In.

Soil Samples NA In. Diam. ____ No.

Soil Samples NA In. Diam. ____ No. — Water Table Depth —

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	40	Spun HW (4") casing
40'	40	telescope NW casing inside HW casing

INDEX

Prepared by Greg Hargraves — Field Data — Lab. Data

Submitted by Atlantic Testing Laboratories Limited

NED FORM DEC 63 121 — REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site North Springfield Dam — Page 1 of 5 Pages

Boring No. HW B1 Desig. HW-B1 Diam. (Casing) HW(4") / NW(3")

Co-ordinates: N _____ E _____

Estimated Elevation Top of Boring 463.0 M.S.L.
Total Overburden Drilled 40 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled — Feet
Elevation Bottom of Boring — M.S.L.
Total Depth of Boring 40 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft : — Diam. — In.
Soil Samples — In. Diam. — No.
Soil Samples — In. Diam. — No.

Hammer Wt. — Boring Started 7 June 88
Hammer Drop — Boring Completed 9 June 88
Casing Left 40'
Subsurface Water Data — Page —
Obs. Well —
Drilled By T. Burnham and T. Stearns
Mfg. Des. Drill CME 850
Inspected By: B. Fairgrave
Classification By: —
Classification By: —

DEPTH 1"=2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
					Advanced HW (4") casing to 5' (the casing was spun) Water was used as a drilling fluid	Possible gravel
					Note: water return	
5'					Advanced casing to 10'	
					Cleaned casing with 3 7/8" roller bit and water	
10'						

GENERAL REMARKS:
Hole was advanced at ≈ 5° angle
Hole depths shown above represent depths from excavation surface ≈ 10' of material was removed prior to drilling

NED FORM 58(Test)

Site	Boring No.	Page 3 of 5
North Springfield Dam	HW-B1	

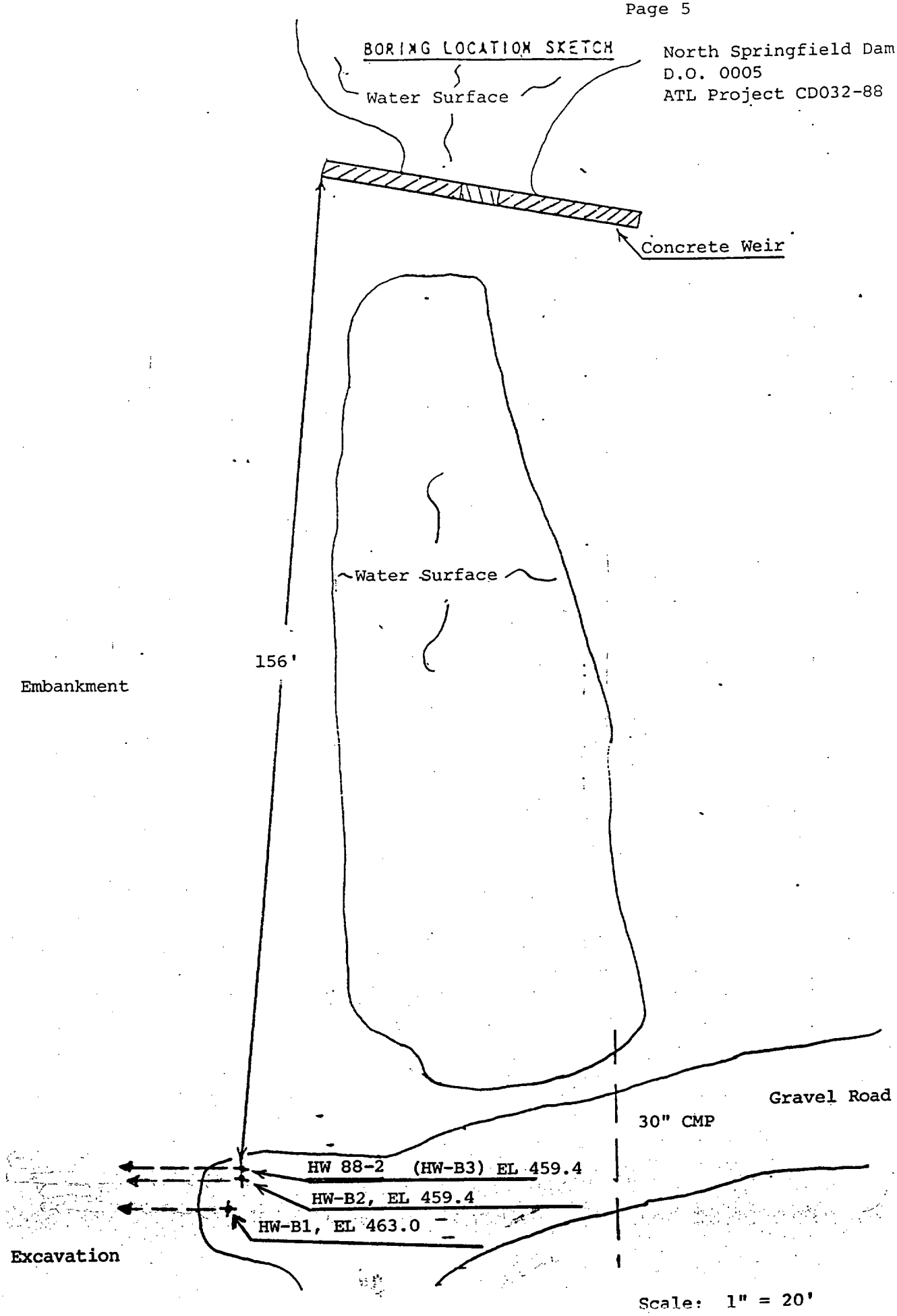
DEPTH	CORE/SAMPLE NO.	CORE/SAMPLE SIZE	CORE/SAMPLE DEPTH RUNS	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10'					Advanced casing to 15'	granular soils
					Note - no water return	
15'					Advanced casing to 17'	
					Advanced roller bit to 18'	
17'						Boulders and cobbles
18'					Advanced casing to 20'	
20'					END OF EXPLORATION 7, June 88	
					EXPLORATION CONTINUED 8, June 88	
					Advanced casing to 25'	
25'					Advanced casing to 30'	

Site	Boring No.	Page 4 of 5
North Springfield Dam	HW-B1	

DEPTH	CORE/SAMPLE			BLOWS PER FT.	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	NO.	SIZE	DEPTH RUN / CORE RECVY			
27					granular soils	
30'					Advanced casing to 34'	
34'					END OF EXPLORATION 8 June 88	
					EXPLORATION CONTINUED 9 June 88 Advanced casing to 40'	
40'					END OF EXPLORATION 9 June 88	
					EXPLORATION CONTINUED 13, June 88 Drillers attempted to advanced boring by telescoping NW casing inside the AW casing without success END OF EXPLORATION 13, June 88	Note: hole was abandoned because drillers could not advanced casing to desired depth
					28, June 88 Drillers attempted to removed HW casing from hole without success, casing was grouted in place	

BORING LOCATION SKETCH

North Springfield Dam
D.O. 0005
ATL Project CD032-88



Scale: 1" = 20'

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. D.O. 0005

Site North Springfield Dam — Page 1 of 4 Pages

Hole No. HW B2 Diam. (Casing) — — Boring Started 29, June 88

Co-ordinates: N _____ E _____ — Boring Completed 29, June 88

Drilled by Jensen, Burnham — Report Submitted 8, July 88

Purpose of Exploration To install horizontal drains to provide seepage relief

Estimated
Elevation Top of Hole 459.4 M.S.L. — Casing Left in Place 0 Feet
Total Overburden Drilled 110 Feet
Elevation Top of Rock — M.S.L.
Elevation Bottom of Hole — M.S.L.
Total Rock Drilled — Feet
Total Depth of Hole 110 Feet
Core Recovered — %
Core Recovered — Ft.: — Diam. — In.
Soil Samples — In. Diam. — No.
Soil Samples — In. Diam. — No. — Water Table Depth —

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	110'	Advanced 3 7/8" roller bit using drilling foam as drilling fluid

INDEX

Prepared by Tom Palher — Field Data — Lab. Data

Submitted by Atlantic Testing Laboratories Limited

NED FORM DEC 63 121 — REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site North Springfield Dam Page 2 of 4 Pages

Boring No. HW B2 Desig. — Diam. (Casing) —

Co-ordinates: N — E —

Estimated
Elevation Top of Boring 459.4 M.S.L. Hammer Wt. — Boring Started 29, June 88
Total Overburden Drilled 110 Feet Hammer Drop — Boring Completed 29, June 88
Elevation Top of Rock — M.S.L. Casing Left 0
Total Rock Drilled — Feet Subsurface Water Data — Page —
Elevation Bottom of Boring — M.S.L. Obs. Well —
Total Depth of Boring 110 Feet Drilled By Jenson Burnham
Core Recovered — % No. Boxes — Mfg. Des. Drill Jenson drill rig
Core Recovered — Ft : — Diam. — In. Inspected By: Tom Palmer
Soil Samples — In. Diam. — No. Classification By: —
Soil Samples — In. Diam. — No. Classification By: —

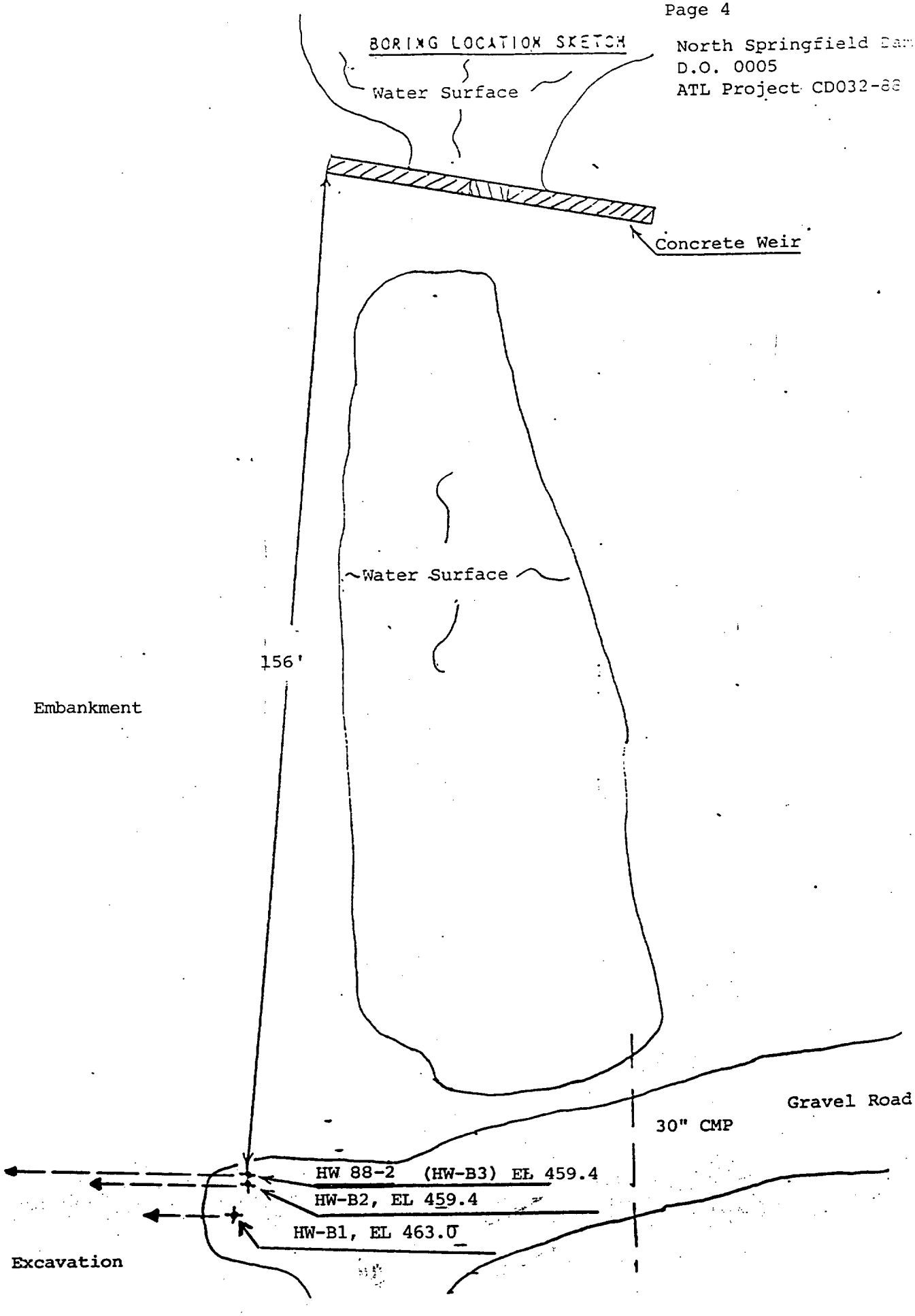
DEPTH	CORE/SAMPLE			BLOWS PER FT.	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 10'	NO.	SIZE	DEPTH RANGE	CORE REC'VY		
10'					Advanced 4" casing using 3 7/8" roller bit and drilling foam to 110'	Granular soils
					drill foam return from embankment near bore hole	
20'						
30'						
40'						Cobbles
50'						

GENERAL REMARKS:
Hole advanced at ≈ 5° angle
Hole was advanced from excavated surface, depth shown on logs reflect depth from excavated surface.
Excavation was ≈ 10' into abutment

Site	Boring No.	Page 3 of 4
North Springfield Dam	HW-B2	

DEPTH	CORE/SAMPLE NO.	CORE/SAMPLE SIZE	CORE/SAMPLE DEPTH RUNS	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
50					slight return of drill foam	
60'					pulled steel due to high torque pressure and high drill foam pressure	
70'					re-enter boring advance boring to 110'	Boulders
80'						
90'					high torque pressure	
100'						
110'					END OF EXPLORATION 29 June 88	
					Note: hole was abandoned because well screen broke during installation New hole was located 1 ft North of old hole	

North Springfield Dam
D.O. 0005
ATL Project CD032-88



CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. D.O. 0005

Site North Springfield Dam — Page 1 of 6 Pages

Hole No. HW 88-2 (HW-B3) Diam. (Casing) 2" ϕ galvanized steel pipe — Boring Started 30 June 88

Co-ordinates: N _____ E _____ — Boring Completed 30 Jun 88

Drilled by Jensen, Burnham — Report Submitted 8 July 88

Purpose of Exploration To develop seepage relief techniques

Elevation Top of Hole 459.4 M.S.L.
Total Overburden Drilled 140 Feet
Elevation Top of Rock — M.S.L.
Elevation Bottom of Hole — M.S.L.
Total Rock Drilled — Feet
Total Depth of Hole 140 Feet
Core Recovered — %
Core Recovered — Ft.; — Diam. — In.
Soil Samples — In. Diam. — No.
Soil Samples — In. Diam. — No.

Casing Left in Place 20' of 2" ϕ galvanized steel pipe Feet

Water Table Depth —

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	140	advanced 3 7/8" roller bit using drilling foam as drill fluid.

INDEX

Prepared by Tom Palher — Field Data — Lab. Data

Submitted by Atlantic Testing Laboratories Limited

MED FORM DEC 63 121 REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site North Springfield Dam VT — Page 2 of 6 Pages

Boring No. HW88-2 Desig. HW-B3 Diam. (Casing) 2" Ø galvanized steel pipe

Co-ordinates: N _____ E _____

Elevation Top of Boring 459.4 M.S.L. — Hammer Wt. — — Boring Started 30 June 88

Total Overburden Drilled 140 Feet — Hammer Drop — — Boring Completed 30 June 88

Elevation Top of Rock — M.S.L. — Casing Left 20' of 2" Ø steel pipe

Total Rock Drilled — Feet — Subsurface Water Data _____ Page _____

Elevation Bottom of Boring — M.S.L. — Obs. Well —

Total Depth of Boring 140 Feet — Drilled By Jensen Durham

Core Recovered — % No. Boxes — — Mfg. Des. Drill Jensen drill rig

Core Recovered — Ft : — Diam. — In. — Inspected By: Tom Pallier

Soil Samples — In. Diam. — No. — Classification By: _____

Soil Samples — In. Diam. — No. — Classification By: _____

DEPTH 1"=10'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10'					Advanced 4" casing using 3 7/8" roller bit and drill foam to 140'	
20'					drill foam return noted coming from embankment near bore hole	
30'						
40'						
50'						

GENERAL REMARKS:

Boring was advanced at ≈ 5° angle
Boring was advanced from excavated surface, which was ± 10' into abutment

Site	Boring No.	Page 3 of 6
North Springfield Dam	HW 88-2 (HW-B3)	

DEPTH	CORE/SAMPLE NO.	CORE/SAMPLE SIZE	CORE/SAMPLE DEPTH RUN	BLOWS PER FT. / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1"=10'						

50'

60'

70'

80'

90'

100'

110'

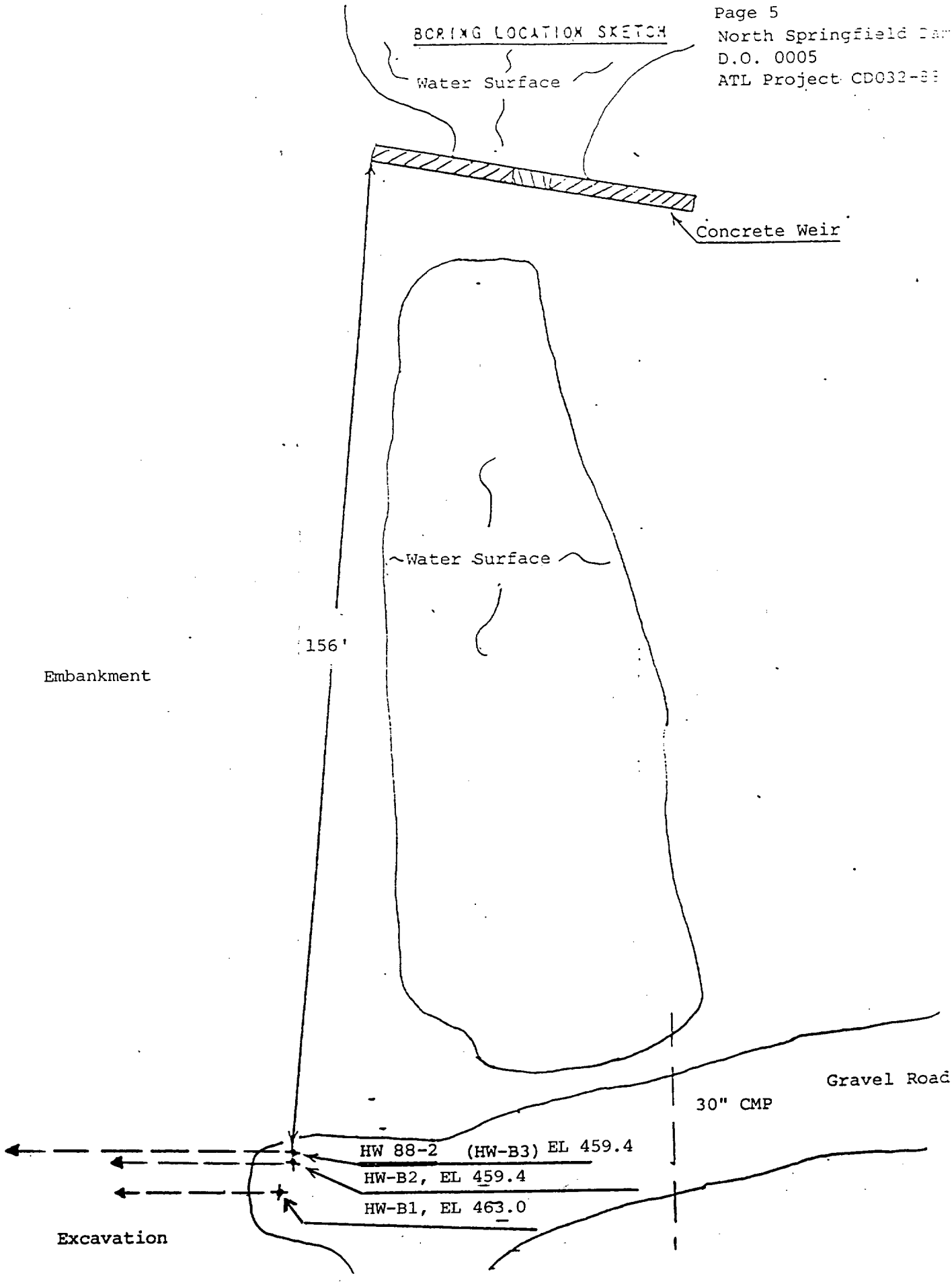
Drillers increased concentration of drill foam stabilizing borehole and reducing torque friction

120

130

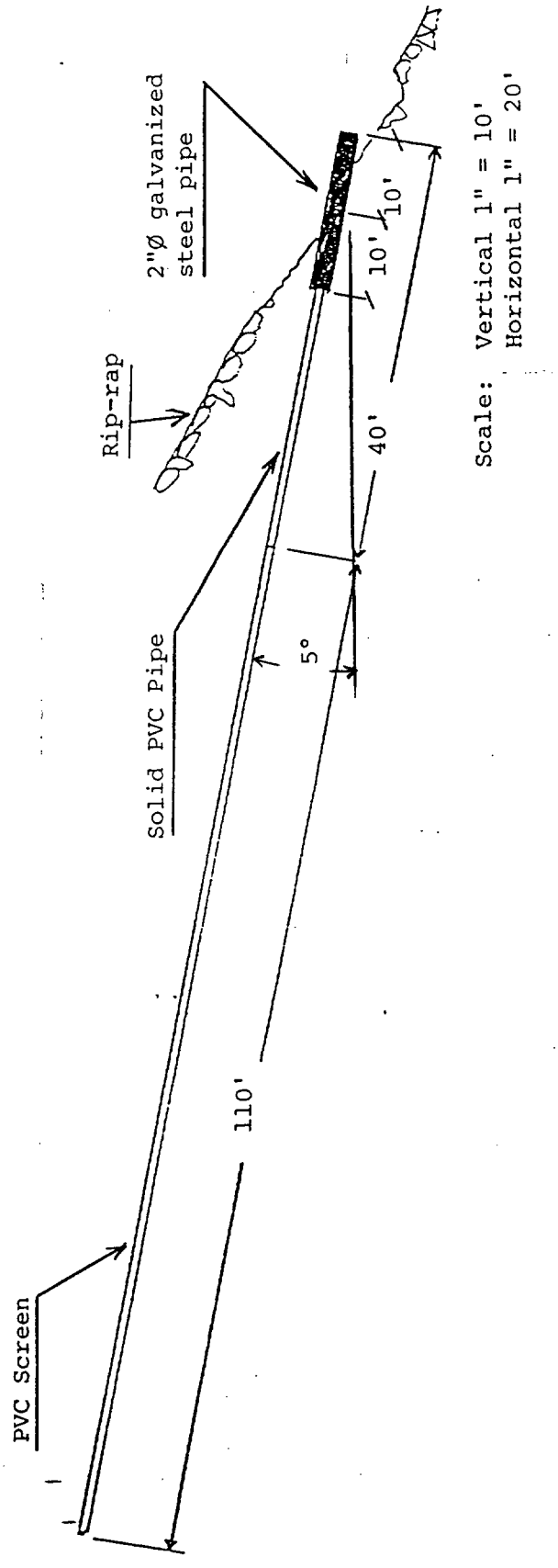
Site	Boring No.	Page 4 of 6
North Springfield Dam	HW 88-2 (HW-B3)	

DEPTH	CORE/SAMPLE NO.	CORE/SAMPLE SIZE	CORE/SAMPLE DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
140'					END OF EXPLORATION 30 June 88	
150					Note: A 1½" Ø drain was installed in this boring, see drain installation detail	


BORING LOCATION SKETCH
Water Surface
Concrete Weir
Water Surface
156'
Embankment
Gravel Road
30" CMP
HW 88-2 (HW-B3) EL 459.4
HW-B2, EL 459.4
HW-B1, EL 463.0
Excavation

ATLANTIC TESTING LABORATORIES, Limited

SUBJECT	JOB NO.	BY	DATE	SHEET
Drain Installation Detail North Springfield Dam, VT	D.O. 0005 CD032-88	GH	7-7-88	Page 6



HW 88-2 (HW-B3)

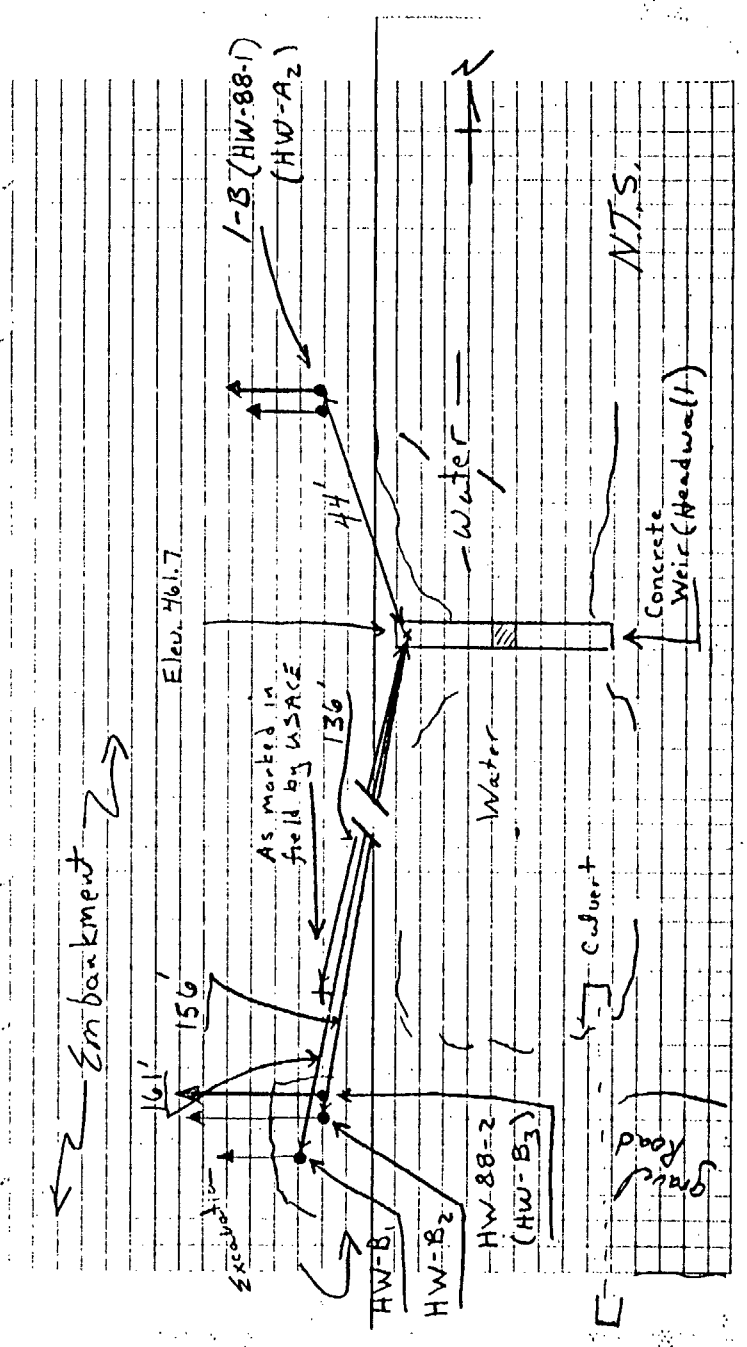
SECTION 8

OTHER RECORDS TAKEN

a. Survey Data

STA	B.S.	H.I.	F.S.	ELEV
Headwall	48"			461.72
1-B (HW88-1)			62 1/4"	460.5
T-O-pipe				
Headwall	16 1/2" (1.38')			461.72
TP-1			81" (6.75')	456.35
	47 1/4" (3.96')			
Culvert			80" (6.67')	453.64
T-O-Pipe	($HW-B_2$)		11" (0.92')	459.39
TP-2			46" (3.83')	456.48
	79 1/2" (6.63)			
Headwall			18 1/2" (1.54')	461.57
			DH = 0.15'	

(Hand level)



SECTION 9

DISCUSSION OF RESULTS

Discussion of Results

In the following discussion, it is our hope that the reader will be enlightened to some of the possibly serious problems facing the contractors who attempt to install low angle drains. Because this particular project was a model for future projects of this type, we feel it has served its purpose quite well in helping to identify not only problem areas but also equipment and techniques that worked quite well.

Starting with the drill rigs, we found that design was an extremely important factor. Because the CME 850 was not designed to efficiently drill horizontal holes, it was of little use on this project. As the reader can see by comparing the activity and drill logs from the holes done by the Jensen drill rig and the CME 850, the Jensen drill rig is a very efficient machine for this type of work.

Although the Delivery Order did not request soil sampling on this project, a rough evaluation of subsurface conditions could be determined by the speed that the boring was advanced, examination of drill wash/cuttings and rate of drill fluid return.

Besides the drill rig design, the proper type and use of drilling fluid proved to be an important contributing factor to the efficiency of the operation. The borings performed with the Jensen drill rig were advanced using drilling foam. By running a high concentration of drilling foam, high torque pressure problems were greatly reduced. When the drilling foam was used properly, it created a bridging action within the boring which helped to hold the hole open. It also had lubrication properties that reduced the friction between the outer drill rod and the boring. The CME 850 used straight water as a drilling fluid; this method of drilling probably contributed to some of the problems this drill rig encountered. By using water, the amount of force needed to turn the drill steel was greater than if the foam had been used because of the friction between the outer casing wall and the boring.

The next point of discussion is the USACE original request for the use of HX casing as a protector pipe around the PVC pipe. The Jensen drill rig was unable to install the HX size protective pipe as originally specified in Attachment 1 of the Delivery Order No. 0005. The drill steel (2" ID) used by the Jensen drill rig, had to be removed prior to the installation of the protective pipe. As soon as the drill steel was removed, the open hole around the PVC drain pipe tended to collapse making it impossible to install the HX casing without damaging the PVC drain pipe due to the resistance from the material that collapsed in the hole. To rectify this situation, 2" diameter galvanized steel pipe was used in lieu of the HX size casing with the approval of Mr. Tim Beauchemin (USACE). The 2" galvanized steel pipe was easily installed after the drill steel was removed because its smaller diameter offered less resistance to the collapsed material in the hole and provided more than adequate protection against vandalism.

Another point of discussion centers around the use of PVC wire wound screen. The use of this type of screen presented two problems: (1) there was a problem obtaining the screen that would meet the USACE specifications, and (2) the screen specified and obtained was substantially weaker than regular PVC slotted screen. In order to obtain 1-1/2" diameter, flush jointed wire wound screen to meet USACE specifications, two manufacturers of well screen had to be employed. The first company, Johnson Well Screen, supplied the well screen and the second company, Diedrich Drilling, welded ends onto the screen so that they could be connected with flush joints. This procedure increased the price of the well screen and the end product proved to be quite flimsy and weak at the joints. The overall weakness of the wire wound screen made it fragile and difficult to work with. This characteristic proved to be expensive when the screen broke at one of its joints during installation in Boring HB-2. When this happened, the drillers had to start a new hole; they lost a large section of screen, a drill bit and all the time it took to drill the hole.

To solve the problem with the wire wound screen, regular PVC machine slotted well screen could be used in lieu of the wire wound screen. The screen would be less expensive, more rigid, have stronger joints and ultimately be less expensive to install.

After the field work for this project was completed, little drainage of the embankment appeared to be taking place. This was probably due to the decreased hydrostatic head within the embankment that occurs during the summer months.

It is our hope that the results of the project will provide insight regarding proper tools, supplies, and techniques to be used in installing low angle drains.